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STANDARD SEVEN

TERM - I

VOLUME - 3

SCIENCE
SOCIAL SCIENCE

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Department of School Education

Untouchability is Inhuman and a Crime

Government of Tamil Nadu

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PREFACE

The Science textbook for standard Seven has been prepared following the guidelines given in the National Curriculum Framework 2005. The book enables the reader to read the text, comprehend and perform the learning experiences with the help of teacher. The Students explore the concepts through activities and by the teacher demonstration. Thus the book is learner centric with simple activities that can be performed by the students under the supervision of teachers.

HOW TO USE THE BOOK?

- The First term VII Science book has seven units.
- Two units planned for every month including computer science chapter has been introduced.
- Each unit comprises of simple activities and experiments that can be done by the teacher through demonstration if necessary student's can perform them.
- Colourful info-graphics and info-bits enhance the visual learning.
- Glossary has been introduced to learn scientific terms.
- The "Do you know?" box can be used to enrich the knowledge of general science around the world.
- ICT Corner and QR code has been introduced in each unit for the first time to enhance digital science skills.

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- Download the QR code scanner from the Google play store/ Apple App Store into your Smart phone.
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- Once the scanner button in the application is clicked, camera opens and then bring it closer to the QR code in the text book.
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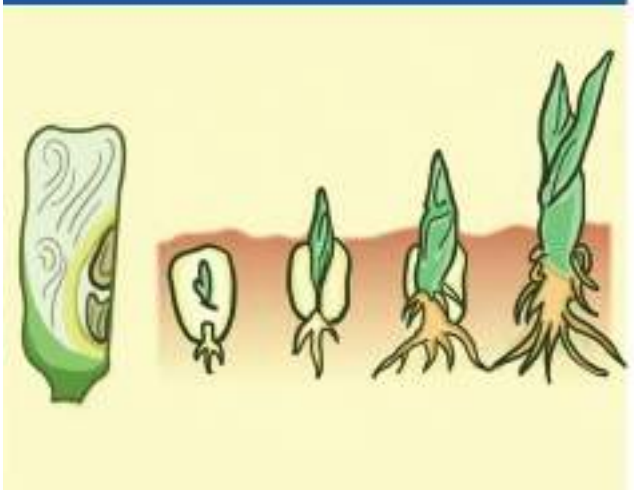
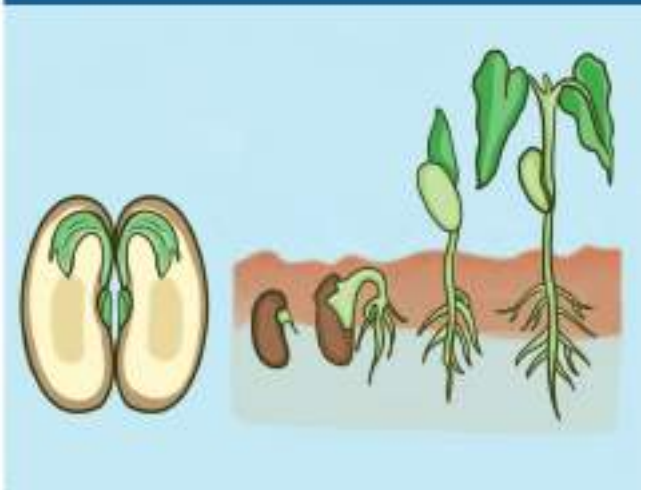
- Click the URL and go to the content page.

Seed Germination of Monocot Plant



Seed Germination of Dicot Plant



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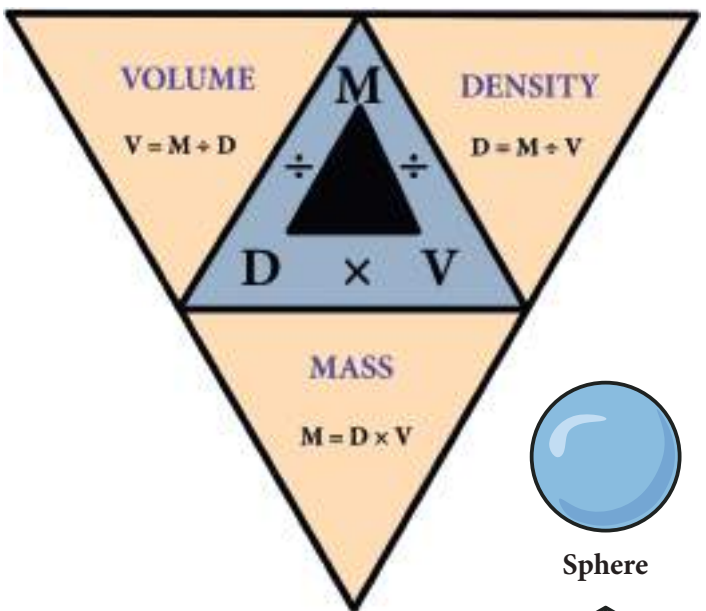
Assessment

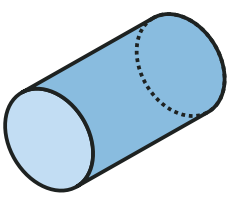
Unit 1

Measurement

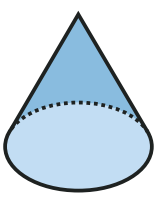


3D Solid Shapes

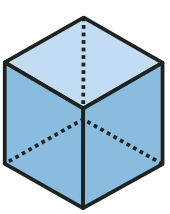
Sphere



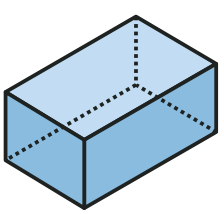
Cylinder



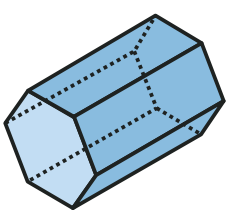
Cone



Cube



Cuboid



Hexagonal

Learning Objectives

After studying this unit, students will be able to:

- identify fundamental and derived physical quantities.
- identify fundamental and derived units.
- obtain units for certain derived quantities.
- measure the area and volume of some regular shaped and irregular shaped objects.
- convert the volume of objects from cubic metre to litre and vice versa.
- calculate the density of solids and liquids.
- define astronomical unit and light year.

Introduction

In day to day life, we measure many things such as weight of fruits, vegetables and food grains, volume of liquids, temperature of the body, speed of the vehicles etc., Quantities such as mass, weight, distance, temperature, volume are called physical quantities. A value and a unit are used to express the magnitude of a physical quantity. For example, let us assume that you walk 2 kilometre everyday. In this example '2' is the value and 'kilometre' is the unit used to express the magnitude of distance which is a physical quantity. In this lesson, we are going to study about fundamental quantities, derived quantities such as area, volume and density, and measurement of larger quantities.

1.1 Fundamental Quantities and Derived Quantities

Generally, physical quantities are classified into two types. They are: fundamental quantities and derived quantities.

1.1.1 Fundamental Quantities

A set of physical quantities which cannot be expressed in terms of any other quantities are known as fundamental quantities. Eg. Length, Mass, Time. Their corresponding units are called fundamental units. There are seven fundamental physical quantities in SI Units (System of International Units). They are given in Table 1.1.

Table 1.1 Fundamental quantities and their units

Fundamental quantity	Fundamental unit
Length	metre (m)
Mass	kilogram (kg)
Time	second (s)
Temperature	Kelvin (K)
Electric current	Ampere (A)
Amount of substance	mole (Mol)
Luminous intensity	Candela (cd)

1.1.2 Derived quantities

All other physical quantities which can be obtained by multiplying, dividing or by mathematically combining the fundamental quantities are known as derived quantities. Eg. Area and volume. Their corresponding units are called derived units. Some of the derived quantities and their units are given in Table 1.2.

Table 1.2 Derived quantities and their units

Derived quantity	Unit
Area = Length × Breadth	m^2
Volume = Length × Breadth × Height	m^3
Speed = Distance / Time	ms^{-1}
Electric Charge = Electric Current × Time	C
Density = Mass / Volume	$kg\ m^{-3}$

*C - Coulomb

1.2 Area

Area is a measure of how much space is there on a flat surface. The area of a plot of land is derived by multiplying its length and breadth.

Area = length × breadth

The unit of the area is m^2 (Read as square metre). Area is a derived quantity as we obtain it by multiplying the fundamental physical quantity length (length x breadth).

Problem 1.1

What is the area of 10 squares each having side of 1 m?

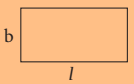
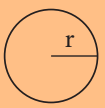
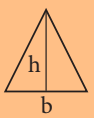
Area of a square = side × side
= 1 m × 1 m
= 1 m^2 or 1 square metre

Area of 10 squares = 1 square metre × 10
= 10 square metre

1.2.1 Area of regularly shaped objects

The area of regularly shaped objects can be calculated using the relevant formulae. In Table 1.3, the formulae used to calculate the area of certain regularly shaped figures are given.

Table 1.3 Area of some regularly shaped objects

S.No.	Plane figure	Diagram	Area
1	Square		side × side $a \times a = a^2$ sq.unit
2	Rectangle		length × breadth $l \times b = lb$ sq.unit
3	Circle		$\pi \times (\text{radius})^2$ $\pi \times r^2 = \pi r^2$ sq.unit
4	Triangle		(1/2) × base × height $1/2 \times b \times h$ sq.unit

Problem 1.2

Find the area of the following regular shaped figures (Take $\pi = 22/7$).

a. A rectangle whose length is 12 m and breadth is 4 m.

b. A circle whose radius is 7 m.

c. A triangle whose base is 6 m and height is 8 m.

Solution

a. Area of rectangle = length × breadth
$= 12 \times 4 = 48 \text{ m}^2$

b. Area of circle $= \pi \times r^2 = (22/7) \times 7 \times 7$
$= 154 \text{ m}^2$

c. Area of triangle = 1/2 × base × height
$= 1/2 \times 6 \times 8 = 24 \text{ m}^2$

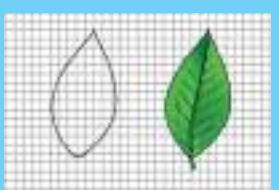
1.2.2 Area of irregularly shaped objects

In our daily life, we encounter many irregularly shaped objects like leaves, maps, stickers of stars or flowers, peacock feather etc. The area of such irregularly shaped objects cannot be calculated using any formula.

How can we find the area of these irregularly shaped objects? We can find the area of these figures with the help of a graph sheet. The following activity shows how to find the area of irregularly shaped plane figures.

ACTIVITY 1

Take a leaf from any one of the trees. Place it on a graph sheet and draw the outline of the leaf with a pencil. Remove the leaf. You can see the outline of the leaf on the graph sheet.



i. Now, count the number of whole squares enclosed within the outline of the leaf. Take it as M.

ii. Then, count the number of squares that are more than half. Take it as N.

iii. Next, count the number of squares which are half of a whole square. Note it as P.

iv. Finally, count the number of squares that are less than half. Let it be Q.

Now, the approximate area of the leaf can be calculated using the following formula.

Approximate area of the leaf
= M + (3/4) N + (1/2) P + (1/4) Q square cm.

Area of the leaf = _____ cm^2.

This method can be used to find the area of regularly shaped figures also. In the case of square and rectangle, this method gives the measure area accurately. This method can be used to calculate the area of any irregularly shaped plane figures.

ACTIVITY 2

Draw the following regularly shaped figures on a graph sheet and find their area by the graphical method. Also, find their area using appropriate formula. Compare the results obtained in two methods by tabulating them.

a. A rectangle whose length is 12 cm and breadth is 4 cm.
b. A square whose side is 6 cm.
c. A circle whose radius is 7 cm.
d. A triangle whose base is 6 cm and height is 8 cm.

S. No.	Shape	Area using formula	Area using graphical method

One square metre is the area enclosed inside a square of side 1 metre. Even though area is given in square metre, the surface need not to be square in shape

1.3 Volume

The amount of space occupied by a three dimensional object is known as its volume.

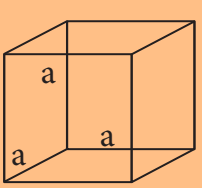
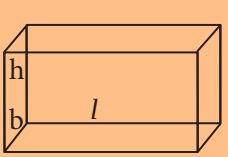
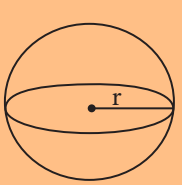
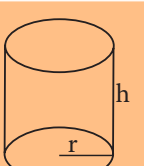
Volume = Surface area × Height

The SI unit of volume is cubic metre or m^3.

1.3.1 Volume of regularly shaped objects

As in the case of area, the volume of a regularly shaped objects can also be determined using an appropriate formula. Table 1.4 gives the formulae used to calculate the volume of the regularly shaped objects.

Table 1.4 Volume of regularly shaped objects

S.No.	Objects	Figure	Volume
1	Cube		side × side × side $a \times a \times a = a^3$ cu.unit
2	Cuboid		length × breadth × height $l \times b \times h = lbh$ cu.unit
3	Sphere		$4/3 \times \pi \times (\text{radius})^3$ $4/3 \times \pi \times r^3 = 4/3\ \pi\ r^3$ cu.unit
4	Cylinder		$\pi \times (\text{radius})^2 \times \text{height}$ $\pi \times r^2 \times h = \pi\ r^2 h$ cu.unit

Problem 1.3

Find the volume of the following (Take $\pi = 22/7$).

a. A cube whose side is 3 cm.
b. A cylinder whose radius is 3 m and height is 7 m.

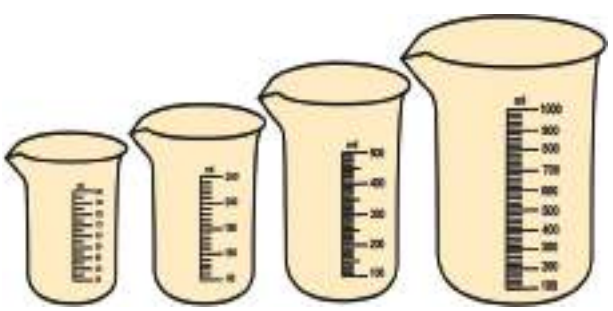
Solution

a. Volume of a cube = side × side × side cu.unit
= 3 cm × 3 cm × 3 cm = 27 cubic cm or cm^3.

b. Volume of a cylinder = $\pi \times (\text{radius})^2 \times \text{height}$
= $22/7 \times 3 \times 3 \times 7 = 198\ m^3$.

1.3.2 Volume of Liquids

Liquids also occupy some space and hence they also have volume. But, liquids do not possess any definite shape. So, the volume of a liquid cannot be determined as in the case of solids. When a liquid is poured into a container, it takes the shape and volume of the container. The volume of any liquid is equal to the space that it fills and it can be measured using a measuring cylinder or measuring beaker. The maximum volume of liquid that a container can hold is known as the capacity of the container. A measuring container is graduated as shown in figure.



Measuring containers

The volume of a liquid is equal to the volume of space it fills in the container. This can be directly observed from the readings marked in the measuring containers. If we notice the measuring cups given in figure carefully, we can observe that the readings are marked in the unit of 'ml'. This actually represents millilitre. To understand this unit of volume, let us first understand how much a litre means. Litre is the commonly used unit to measure the volume of liquids. We know that the unit of volume is cubic cm if the dimensions of the object are given in cm. This cubic cm is commonly known as 'cc'. A volume of 1000 cc is termed as one litre (*l*).

1 litre = 1000 cc or cm^3

1000 ml = 1 litre

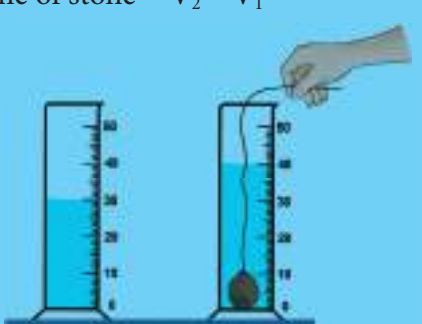
1.3.3 Volume of irregularly shaped objects

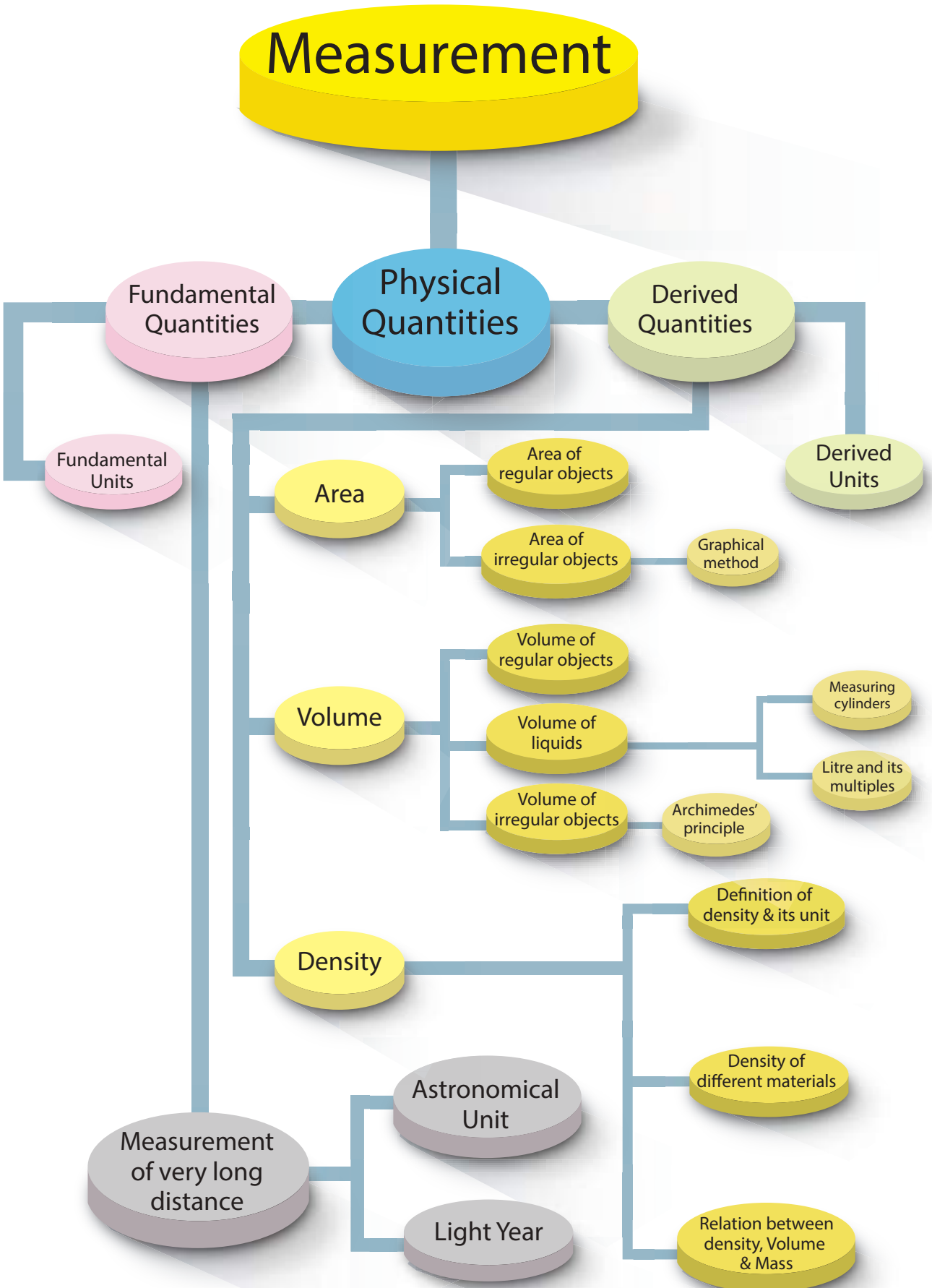
There is no formula to determine the volume of irregularly shaped objects as in the case of area. For such objects, volume can be determined using a measuring cylinder and water.

ACTIVITY 3

Take a measuring cylinder and pour some water into it (Do not fill the cylinder completely). Note down the volume of water from the readings of the measuring cylinder. Take it as V_1. Now take a small stone and tie it with a thread. Immerse the stone inside the water by holding the thread. This has to be done such that the stone does not touch the walls of the measuring cylinder. Now, the level of water will raise. Note down the volume of water and take it as V_2. The volume of the stone is equal to the raise in the volume of water.

Volume of stone = $V_2 - V_1$




Measurement
Physical Quantities
Fundamental Quantities
Derived Quantities
Fundamental Units
Derived Units
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Area of irregular objects
Graphical method
Volume
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Volume of irregular objects
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Density
Definition of density & its unit
Density of different materials
Relation between density, Volume & Mass
Measurement of very long distance
Astronomical Unit
Light Year

DO YOU KNOW?

To measure the volume of liquids, some other units are also used. Some of them are gallon, ounce, and quart.

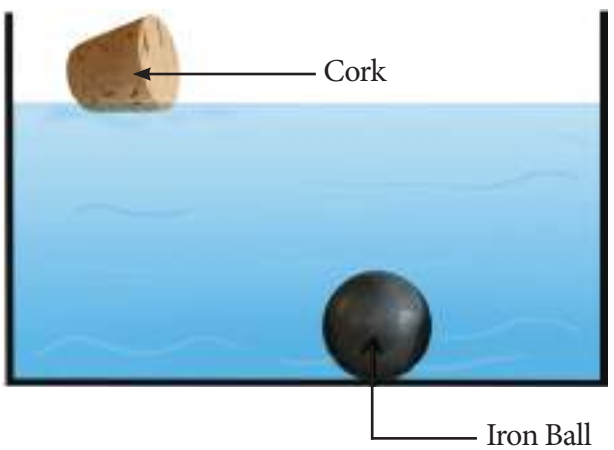
1 gallon = 3785 ml

1 ounce = 30 ml

1 quart = 1 litre

1.4 Density

Take water in a beaker and drop an iron ball and a cork into the water. What do you observe? The iron ball sinks and the cork floats as shown in figure. Can you explain why?



Iron ball sinks while cork floats in water

If your answer is heavy objects sink in water and lighter objects float in water, then, why does a metal coin sinks in water whereas a much heavier wooden log floats? These questions can be answered if we understand the concept of density.

Lighter coin sinks while heavier wooden log floats

ACTIVITY 4

a. Take an iron block and a wooden block of same mass (say 1kg each). Measure their volume. Which one has more volume and occupies more volume?
Ans: _____

b. Take an iron block and a wooden block of same size. Weigh them and measure their mass. Which one of them has more mass?
Ans: _____

From activity 4, we observe that wooden block occupies more volume than the iron ball of same mass. Also, we observe that wooden block is lighter than the iron block of same size.

The lightness or heaviness of a body is due to density. If more mass is packed into some volume, it has greater density. So, the iron block will have more mass than the wooden block of the same size. Therefore, iron has more density.

Density of a substance is defined as the mass of the substance contained in unit volume (1 m^3). If the mass of a substance is M and volume is V, then, its density is given as

$$Density\ (D) = \frac{Mass\ (M)}{Volume\ (V)}$$

$$D = \frac{M}{V}$$

SI unit of density is kg/m^3. The CGS unit of density is g/cm^3.

1.4.1 Density of different materials

Different materials have different densities. The materials with more density are called denser and the materials with less density are called rarer. The density of some widely used materials are listed in Table 1.4.

Table 1.5 Density of some common substances, at room temperature

S.No.	Nature	Materials	Density (kg/m^3)
1	Gas	Air	1.2
2	Liquid	Kerosene	800
3		Water	1,000
4		Mercury	13,600
5	Solid	Wood	770
6		Aluminium	2,700
7		Iron	7,800
8		Copper	8,900
9		Silver	10,500
10		Gold	19,300

The relationship between mass, density and volume are represented in the following density triangle.

- Density = Mass/ Volume
- Mass = Density × Volume
- Volume = Mass / Density

Problem 1.4

A solid cylinder of mass 280 kg has a volume of 4 m^3. Find the density of cylinder.

Solution

$$\text{Density of cylinder} = \frac{\text{Mass of cylinder}}{\text{Volume of cylinder}}$$

$$= \frac{280}{4} = 70\ kg/m^3$$

Problem 1.5

A box is made up of iron and it has a volume of 125 cm^3. Find its mass if the density of iron is 7.8 g / cm^3.

Solution

Density = Mass / Volume

Hence, Mass = Volume × Density

= 125 × 7.8 = 975 g.

Water has more density than oils like cooking oil and castor oil, although these oils appear to be denser than water. Density of castor oil is 961 kg/m3. If we put one drop of water in oil, water drop sinks. But, if we put one drop of oil in water, oil floats and forms a layer on water surface. However, some oils are denser than water.

Problem 1.6

A sphere is made from copper whose mass is 3000 kg. If the density of copper is 8900 kg/m, find the volume of the sphere.

Solution

Density = Mass / Volume

Hence, Volume = Mass / Density

= 3000 / 8900 = 30 / 89

= 0.34 m^3

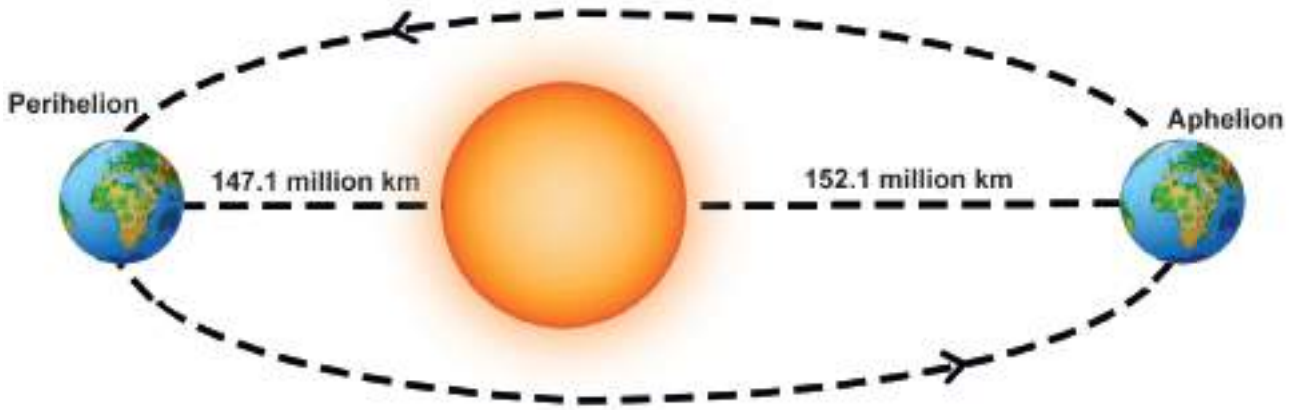
1.5 Measuring larger distances

Normally, we use centimetre, metre and kilometre to express the distances that we measure in our day to day life. But, for space research, astronomers need to measure very long distances such as the distance between the earth and a star or the distance between two stars. To express these distances, we shall learn about two such units, namely,

i. Astronomical unit
ii. Light year

1.5.1 Astronomical Unit

We all know that the earth revolves around the sun in an elliptical orbit. Hence, the distance between the sun and the earth varies every day. When the earth is in its perihelion position (the position when the distance between the Earth and the Sun is short), the distance between



Perihelion and Aphelion position of Earth

the earth and the sun is about 147.1 million kilometre. When the earth is in its aphelion position, (the position when the distance between Earth and the Sun is the largest) the distance is 152.1 million kilometre. The average distance between the earth and the sun is about 149.6 million kilometre. This average distance is taken as one astronomical unit. Neptune is 30 AU away from the Sun. It means it is thirty times farther than the Earth.

One astronomical unit is defined as the average distance between the earth and the sun.

1 AU = 149.6 million km

$= 149.6 \times 10^6$ km $= 1.496 \times 10^{11}$ m.

1.5.2 Light year

The nearest star to our solar system is Proxima Centauri. It is at a distance of 2,68,770 AU. We can note here that using AU for measuring distances of stars would be unwieldy. Therefore, astronomers use a special unit, called 'light year', for measuring the distance in deep space. We have learnt that the speed of light in vacuum is 3×10^8 m/s. This means that light travels a distance of 3×10^8 m in one second. In a year (non-leap), there are 365 days. Each day has 24 hours, each hour has 60 minutes and each minute has 60 seconds.

Thus, the total number of seconds in one year

$= 365 \times 24 \times 60 \times 60$

$= 3.153 \times 10^7$ second

If light travels at a distance of 3×10^8 m in one second, then the distance travelled by light in one year = $3 \times 10^8 \times 3.153 \times 10^7 = 9.46 \times 10^{15}$ m. This distance is known as one light year.

One light year is defined as the distance travelled by light in vacuum during the period of one year.

1 Light year = 9.46×10^{15} m.

In terms of light year, Proxima Centauri is at 4.22 light-years from Earth and the Solar System. The Earth is located about 25,000 light-years away from the galactic centre.

Points to Remember

- A set of physical quantities which cannot be expressed in terms of any other quantities are known as fundamental quantities. Their corresponding units are called fundamental units.
- The physical quantities which can be obtained by mathematically combining (i.e., multiplying and dividing) the fundamental quantities are known as

derived quantities. Their corresponding units are called derived units.

- The area of a figure is the region covered by the boundary of the figure. Its SI unit is square metre or m^2.
- The area of irregularly shaped figures can be calculated with the help of a graph sheet.
- The amount of space occupied by a three dimensional object is known as its volume. The SI unit of volume is cubic metre or m^3.
- The volume of liquids are expressed in terms of litre. One litre = 1000 cc.
- The maximum volume of a liquid that a container can is known as the capacity of the container.
- Density of a substance is defined as the mass of the substance contained in unit volume (1 m^3).
- SI unit of density is kg/m^3. The CGS unit of density is g/cm^3. $1 g/cm^3 = 10^3 kg/m^3$.
- The materials with higher density are called denser materials and the materials with lower density are called rarer materials.
- If the density of a solid is higher than that of a liquid, it sinks in that liquid. If the density of a solid is lower than that of a liquid, it floats in that liquid.
- Density = Mass / Volume

  Mass = Density × Volume

  Volume = Mass / Density
- One astronomical unit is defined as the average distance between the Earth and the Sun. 1 AU = 149.6×10^6 km = 1.496×10^{11} m.
- One light year is defined as the distance travelled by light in vacuum during the period of one year. 1 Light year = 9.46×10^{15} m.

Evaluation

RVHLE

I. Choose the best answer.

1. Which of the following is a derived quantity?
   a) mass b) time
   c) area d) length
2. Which of the following is correct?
   a) 1L = 1cc b) 1L = 10 cc
   c) 1L = 100 cc d) 1L = 1000 cc
3. SI unit of density is
   a) kg/m^2 b) kg/m^3 c) kg/m d) g/m^3
4. Two spheres have mass and volume in the ratio 2:1. The ratio of their density is
   a) 1:2 b) 2:1 c) 4:1 d) 1:4
5. Light year is the unit of
   a) distance b) time
   c) density d) Both length and time

II. Fill in the blanks.

1. Volume of irregularly shaped objects are measured using the law of _____.
2. One cubic metre is equal to _____ cubic centimetre.
3. Density of mercury is _____.
4. One astronomical unit is equal to _____.
5. The area of a leaf can be measured using a _____.

III. State true or false. If false, correct the statement.

1. The region covered by the boundary of a plane figure is called its volume.

2. Volume of liquids can be found using measuring containers.
3. Water is denser than kerosene.
4. A ball of iron floats in mercury.
5. A substance which contains less number of molecules per unit volume is said to be denser.

IV. Match the following items.

a.

1. Area	a. light year
2. Distance	b. m^3
3. Density	c. m^2
4. Volume	d. kg
5. Mass	e. kg / m^3

b.

1. Area	a. g / cm^3
2. Length	b. measuring jar
3. Density	c. amount of a substance
4. Volume	d. rope
5. Mass	e. plane figures

V. Arrange the following in correct sequence.

1. 1L, 100 cc, 10 L, 10 cc
2. Copper, Aluminium, Gold, Iron

VI. Use the analogy to fill in the blank

1. Area : m^2 :: Volume : _____
2. Liquid : Litre :: Solid : _____
3. Water : Kerosene :: _____ : Aluminium

VII. Consider the following statements and choose the correct option.

1. **Assertion:** Volume of a stone is found using a measuring cylinder.
   Reason: Stone is an irregularly shaped object.
2. **Assertion:** Wood floats in water.
   Reason: Water is a transparent liquid.
3. **Assertion:** Iron ball sinks in water.
   Reason: Water is denser than iron.
   a. Both assertion and reason are true and reason is the correct explanation of assertion.
   b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c. Assertion is true but reason is false.
   d. Assertion is false but reason is true.

VIII. Answer very briefly.

1. Name some of the derived quantities.
2. Give the value of one light year.
3. Write down the formula used to find the volume of a cylinder.
4. Give the formula to find the density of objects.
5. Name the liquid in which iron ball sinks.
6. Name the units used to measure the distance between celestial objects.
7. What is the density of gold?

IX. Answer briefly.

1. What are derived quantities?
2. Distinguish between the volume of liquid and capacity of a container.
3. Define the density of objects.
4. What is one light year?
5. Define - Astronomical unit.

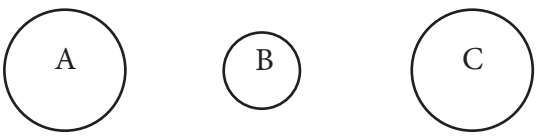
X. Answer in detail.

1. Describe the graphical method to find the area of an irregularly shaped plane figure.
2. How will you determine the density of a stone using a measuring jar?

XI. Questions based on Higher Order Thinking Skills:

There are three spheres A, B, C as shown below.

Sphere A and B are made of same material. Sphere C is made of a different material. Spheres A and C have equal radii. The radius of sphere B is half that of A. Density of A is double that of C.



Now answer the following questions.

i. Find the ratio of masses of spheres A and B.

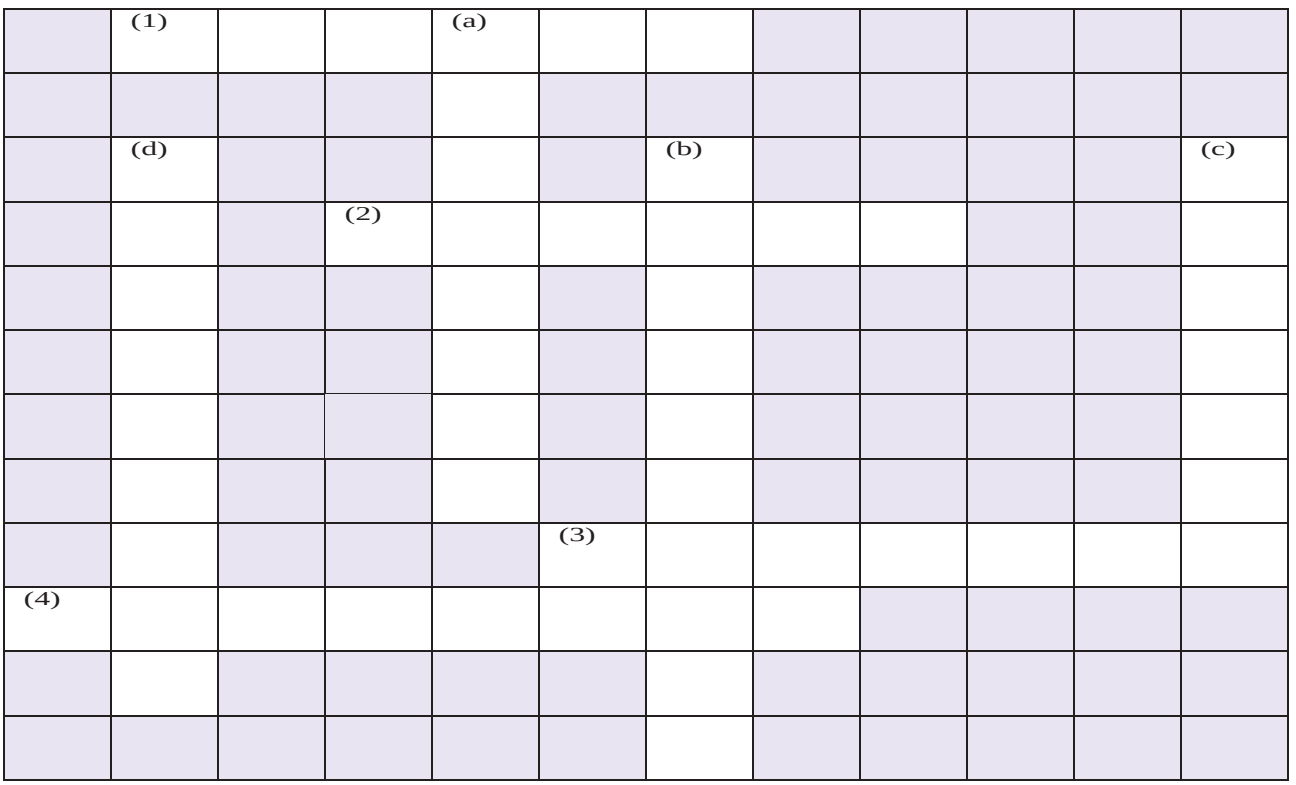
ii. Find the ratio of volumes of spheres A and B.

iii. Find the ratio of masses of spheres A and C.

XII. Numerical problems:

1. A circular disc has a radius 10 cm. Find the area of the disc in m^2 (Use $\pi = 3.14$).
2. The dimension of a school playground is 800 m × 500 m. Find the area of the ground.
3. Two spheres of same size are made from copper and iron respectively. Find the ratio between their masses (Density of copper is 8,900 kg/m^3 and iron is 7,800 kg/m^3).
4. A liquid having a mass of 250 g fills a space of 1000 cc. Find the density of the liquid.
5. A sphere of radius 1cm is made from silver. If the mass of the sphere is 33g, find the density of silver (Take $\pi = 3.14$).

XIII. Cross word puzzle.



Clues – Across

1. SI unit of temperature; 2. A derived quantity; 3. Mass per unit volume; 4. Maximum volume of liquid a container can hold

Clues – Down

a. A derived quantity b. SI unit of volume c. A liquid denser than iron d. A unit of length used to measure very long distances

Answer

1. Kelvin; 2. Volume; 3. Density; 4. Capacity a. Velocity; b. Cubic metre; c. Mercury; d. Lightyear

ICT CORNER

Measurement

Let's know about the effects of mass and volume on density.

PROCEDURE :

Step 1: Use the URL or scan the QR code to open the activity page.

Step 2: Select the options at top right side window to customize

Step 3: Move the sliders on the top left-side window to change the Material and Mass, Volume. Now see the effects of mass and volume on density.

Step 4: Click 'Reset all' button to refresh

Step 1

Step 2

Step 3

Step 4

Measurement URL:

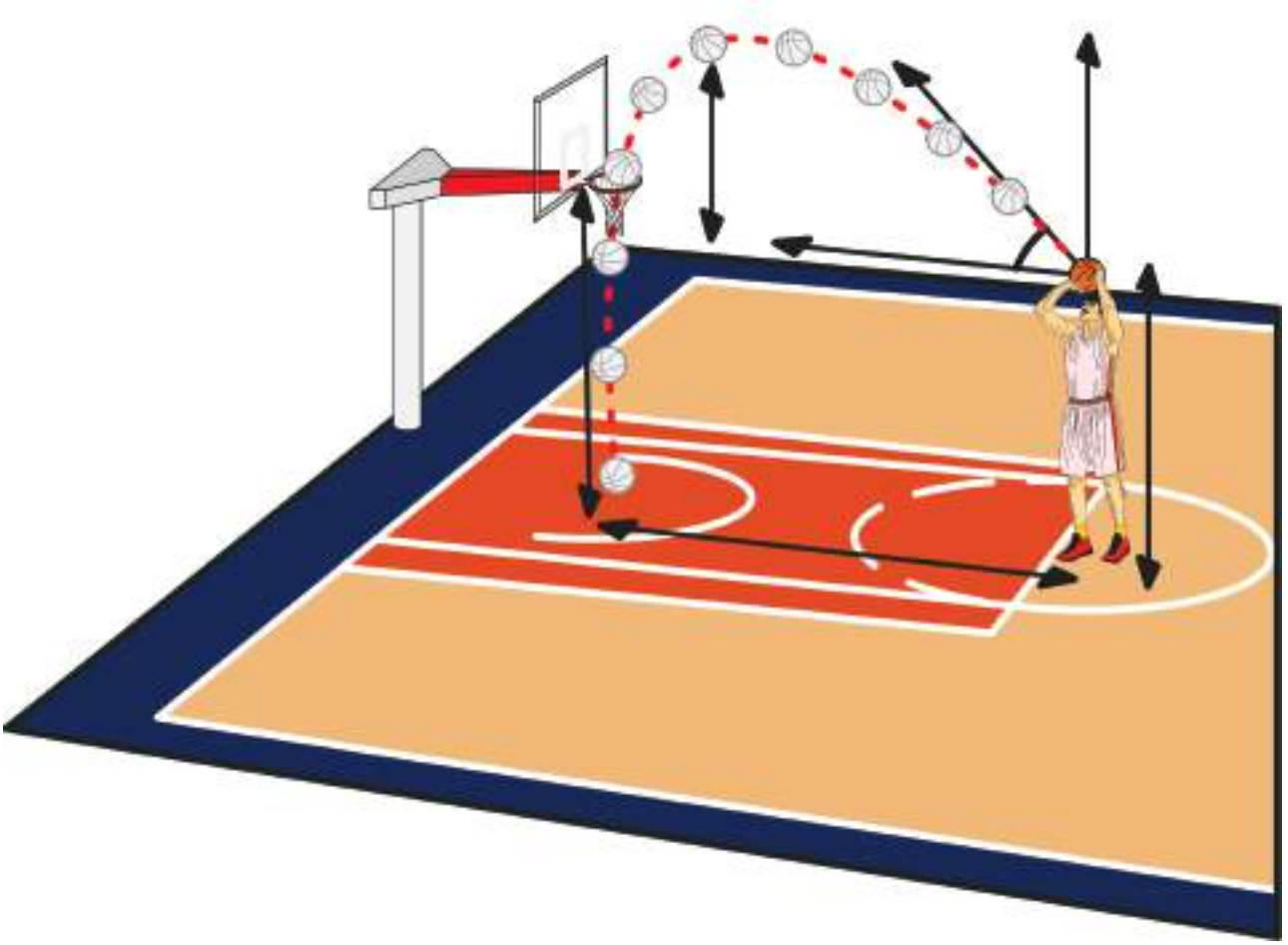
https://phet.colorado.edu/en/simulation/density (or) scan the QR Code

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.

Unit 2

Force and Motion



Learning Objectives

After studying this unit, students will be able to:

- define distance and displacement.
- differentiate distance and displacement.
- define speed, velocity and acceleration.
- differentiate speed and velocity.
- draw and explain distance - time and velocity - time graphs.
- measure and calculate the speed of moving objects.
- know the day to day uses of centre of gravity and stability.

ZFAL3

Introduction

Look at the picture given below. Kavitha can reach her school in two ways, as shown in the picture. Can you tell, by choosing which path she could reach the school early?

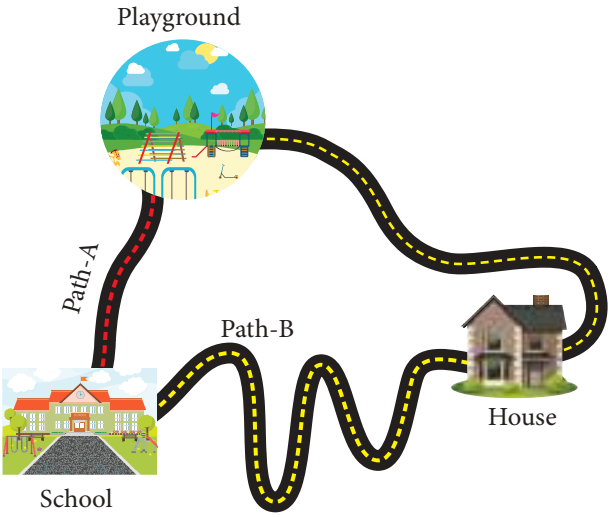
In the picture given below, you can see leaf falling from a tree. In which path the leaf will reach the ground first?

Path of the leaf, when there is no wind.

Path of the leaf when there is wind.

Uma and Priya are friends studying in the same school. After school hours, they go to the nearby playground, play games and return back home. One day Uma told that she would reach the playground after visiting her grandmother's house. The paths which they took to reach the playground is shown here.

Take a twine and measure the length of the two paths (A and B). Which is the longest path among the two?



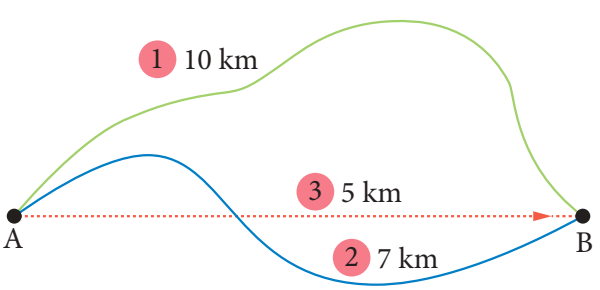
From the above examples, we could conclude that when an object travels from one place to another, it will reach faster if it travels along the straight line path. The straight line path is the shortest distance between two points.

In this lesson we are going to study about distance and displacement, speed and velocity, acceleration, distance - time graph, velocity - time graph, centre of gravity and stability.

2.1 Distance and Displacement

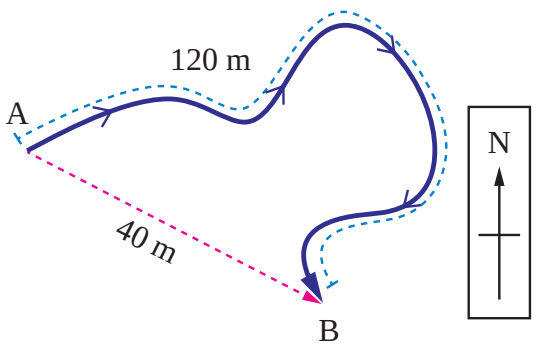
The total length of a path taken by an object to reach one place from another place is called distance. The shortest distance from the initial position to the final position of an object is called displacement. Both distance and displacement possess the same unit. The SI unit distance and displacement is metre (m).

The figure given below shows the motion of a person between two places A and B.

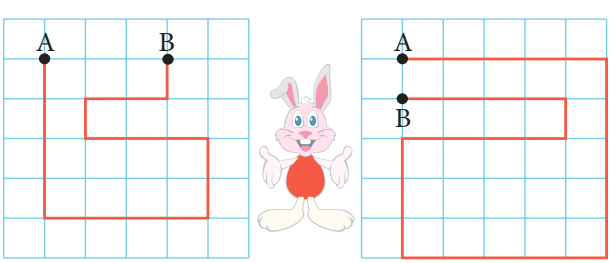


He travels 10 km along the first path. Along the second path, he travels 7 km. The distance between A and B in the case of first path is 10 km. In the case of second path, the distance is 7 km. The shortest distance between the two places is 5 km which is represented by the third path. So, the displacement is 5 km (In east direction).

The path of an object moving from point A to point B is shown in the figure. Total distance travelled by the object is 120 m. The displacement of the object is 40 m (south - east direction).



The path in which a rabbit ran is shown in the figure below. Let us consider that each square is in an unit of one square meter. The rabbit starts from point A and reaches the point B. Find the distance and displacement of it in the two figures. When will the distance and displacement be equal? (The starting point and the finishing point should be different).



Distance _____ Distance _____

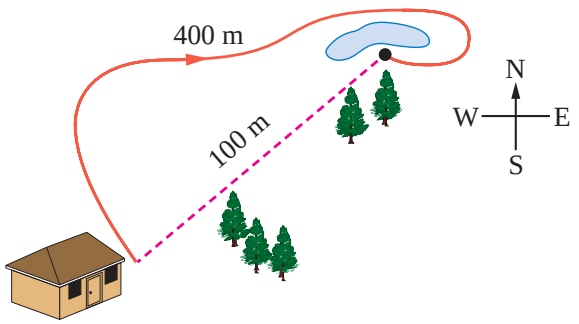
Displacement _____ Displacement _____

When we represent the displacement, we use a positive or negative sign depending on the direction in which it travels.

Let us consider the point A as the starting point. While the object moves from A to B the displacement is considered to be positive and it is negative, when it travels from B to A.

Subha goes to the nearby playground from her home. Look at the picture and answer the following questions.

1. What is the distance she travelled?
2. What is her displacement?



Can you answer the following questions?

- ❖ The distance travelled by an object is 15 km and its displacement is 15 km. What do you infer from this?
- ❖ The distance travelled by a person is 30 km and his displacement is 0 km. What do you infer from this?

Nautical mile

Nautical mile is the unit for measuring the distance in the field of aviation and sea transportation. One nautical mile is 1.852 km.

The unit for measuring the speed of aeroplanes and ships is knot. It means that they travel one nautical mile in one hour.

2.2 Speed - Velocity

2.2.1 Speed

In sixth standard you have already studied about speed in detail. Speed is the rate of change of distance.

Speed = Distance / Time

The unit of speed is metre/second (m/s).

We can classify speed into two types.

Uniform speed

If a body in motion covers equal distances in equal intervals of time, then the body is said to be in uniform speed.

Non- uniform speed

If a body covers unequal distances in equal intervals of time, the body is said to be in non-uniform speed.

$$\text{Average Speed} = \frac{\text{Total distance travelled}}{\text{Time taken to travel the distance}}$$

1 km/h = 5/18 m/s

How we got this ?

1 km = 1000 m; 1 h = 3600 s

1 km / h = 1000 m / 3600 s = 5/ 18 m /s

Know the speed

Tortoise	0.1 m/s
Person walking	1.4 m/s
Falling raindrop	9-10 m/s
Cat running	14 m/s
Cycling	20-25 km/h
Cheetah running	31 m/s
Bowling speed of fast bowlers	90-100 miles /h
Badminton smash	80-90 m/s
Passenger jet	180 m/s
Rocket	5200 m/s

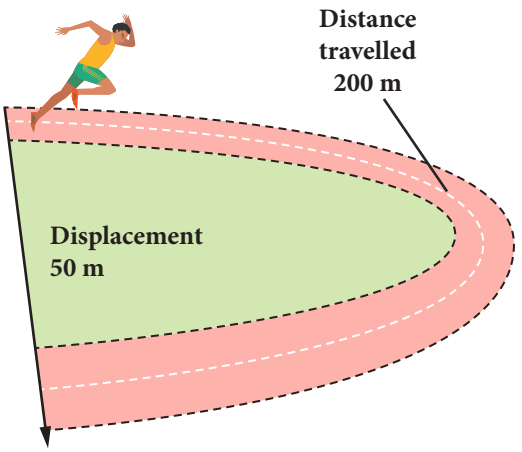
2.2.2 Velocity

Velocity is the rate of change in displacement.

Velocity (v) = Displacement / Time

SI unit of velocity is metre / second (m/s).

Look at the figure. An athlete takes 25 s to complete a 200 m sprint event. Find her speed and velocity.



$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{200}{25} = 8 \text{ m/s}$$

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}} = \frac{50}{25} = 2 \text{ m/s}$$

Uniform velocity

A body is said to have uniform velocity, if it covers equal displacement at equal intervals of time in the same direction. **E.g.** Light travels through vacuum.

Non-uniform velocity

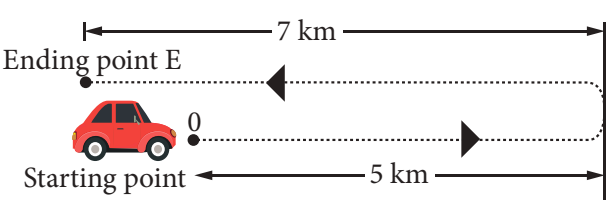
If either speed or direction changes, the velocity is non-uniform. **E.g.** A train starting and moving out of the station.

Average velocity

If the total displacement of an object is divided by the total time taken by the object we get the average velocity.

$$\text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time taken}}$$

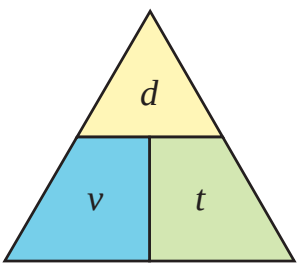
In the figure given below, a car travels 5 km due east and makes a U – turn to travel another 7 km. If the time taken for the whole journey is 0.2 h, calculate the average velocity of the car.



Average velocity = Total displacement/Time taken.
(Taking the direction due east of point O as positive)

Average velocity = (5 – 7) / 0.2
= –2 / 0.2
= –10 km/h or – 10 × 5/18
= – 25/9 = –0.28 m/s

The triangle method can help you to recall the relationship between velocity (v), displacement (d), and time(t).



v = d / t , t = d / v, d = v × t

Answer the following questions.

- Calculate the velocity of a car travelling with a uniform velocity covering 100 m in 4 seconds.
- Usain Bolt covers 100 m in 9.58 seconds. Calculate his speed. If Usain Bolt competes with a Cheetah which is running at a speed of 30 m/s, who will be the winner?
- You are walking along east direction covering a distance of 4 m, then 2 m towards south, then 4 m towards west and at last 2 m towards north. You cover the total distance in 21 seconds. What is your average speed and average velocity?

2.3 Acceleration

Acceleration is the rate of change of velocity. In other words, if a body changes its speed or direction then it is said to be accelerated.

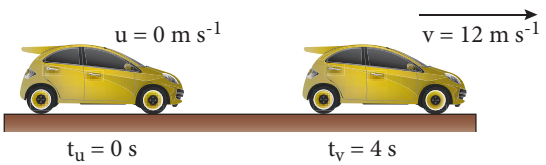
$$\text{Acceleration} = \frac{\text{Change in velocity}}{\text{Time}}$$

$$= \frac{\text{Final velocity (v)} - \text{Initial velocity (u)}}{\text{Time}}$$

$$a = \frac{(v - u)}{t}$$

SI unit of acceleration is m/s^2

A car at rest starts to travel in a straight line path. It reaches a velocity of 12 m/s in 4 s . What is its acceleration, assuming that it accelerates uniformly?



Initial velocity, u = 0 m/s (Since the car starts from rest)
Final velocity (v) = 12 m /s
Time taken (t) = 4 s

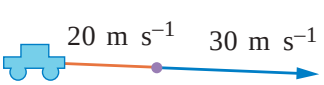
$$\text{Acceleration (a)} = \frac{(v - u)}{t} = \frac{(12 - 0)}{4} = 3\,m/s^2$$

See how brisk I am !

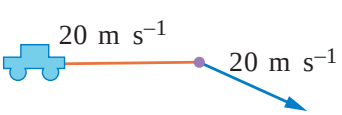
My name is cheetah. I can run at great speed. Do you know what my speed is? It is 25 m/s to 30 m/s. My speed changes from 0 to 20 m/s in 2 second. See how good my acceleration is ! Can you calculate it?

2.3.1 Positive acceleration

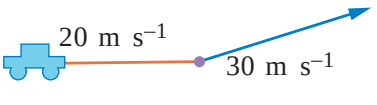
If the velocity of an object increases with respect to time, then the object is said to be in positive acceleration.



(a) Change in speed

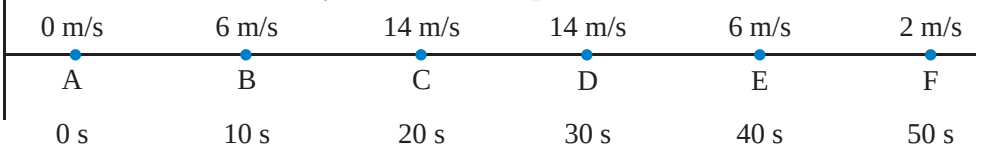


(b) Change in direction



(c) Change in both speed and direction

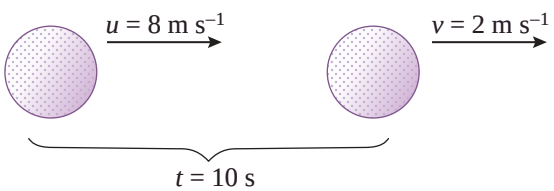
The velocity of a train at different times is given in the figure. Analyse this and complete the table .



The distance travelled by train	Initial velocity (u) m/s	Final velocity (v) m/s	Change in velocity (v – u) m/s	Time taken (t) s	Acceleration = Change in velocity / Time a = (v – u) / t m / s^2
A-B	0	6	6	10	0.6
B-C					
C-D					
D-E					
E-F					

2.3.2 Negative acceleration or Deceleration or Retardation

If the velocity of an object decreases with respect to time, then the object is said to be in negative acceleration or deceleration or retardation.



The velocity of a golf ball rolling in a straight line changes from 8 m/s to 2 m/s in 10 s. What is its deceleration, assuming that it is decelerating uniformly ?

Initial velocity (u) = 8 m/s

Final velocity (v) = 2 m/s

Time taken(t) = 10 s

Acceleration (a) = $\frac{(v - u)}{t} = \frac{(2 - 8)}{10} = -0.6\,m/s^2$

The deceleration is –0.6 m/s^2

2.3.3 Uniform acceleration

An object undergoes uniform acceleration when the change (increase or decrease) in its velocity for every unit of time is the same.

The table given below shows the uniform acceleration of a bus.

Time (s)	1	2	3	4	5
Velocity (m/s)	20+20	40+20	60+20	80+20	100 + 20
	(acceleration)				
Velocity (m/s)	100–20	80-20	60-20	40-20	20-20
	(deceleration)				

When the velocity of the object is increasing by 20 m/s the acceleration is 20 m/s^2 . When the velocity of the object is decreasing by 20 m/s the deceleration is 20 m/s^2 .

2.3.4 Non – uniform acceleration

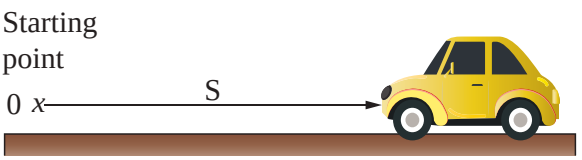
An object undergoes non–uniform acceleration if the change in its velocity for every unit of time is not the same.

Time (s)	0	1	2	3	4	5
Velocity (m/s)	0	10	40	60	70	50
Change in Velocity (m/s)	0	10	30	20	10	20

Note here that the change in velocity is not the same for every second. Thus, the moving object is undergoing non-uniform acceleration.

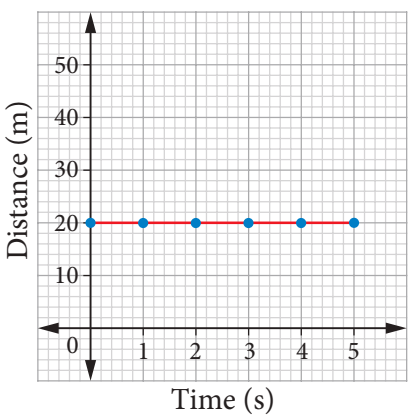
2.4 Distance – Time Graphs

A car travelling along a straight line away from the starting point O is shown in the figure. The distance of the car is measured for every second. The distance and time are recorded and a graph is plotted using the data. The results for four possible journeys are shown below.



a. Car at rest

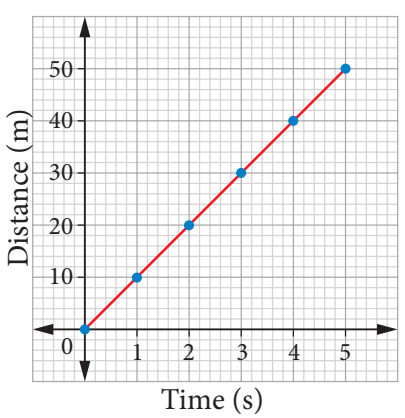
Time (s)	0	1	2	3	4	5
Distance (m)	20	20	20	20	20	20



The graph has zero gradient. i.e. the distance is constant for every second. Thus, the car is at rest.

b. Car travelling at uniform speed of 10ms^{-1}

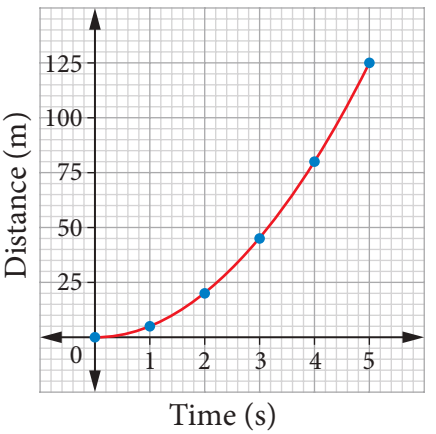
Time (s)	0	1	2	3	4	5
Distance (m)	0	10	20	30	40	50



The graph has constant gradient. The distance increases 10 m in every second. Thus, the car moves with uniform speed.

c. Car travelling at increasing speed

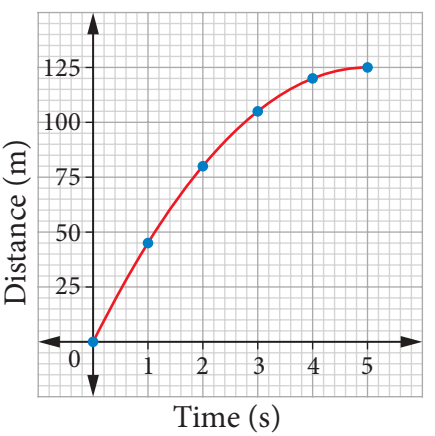
Time (s)	0	1	2	3	4	5
Distance (m)	0	5	20	45	80	125



The graph has an increasing gradient, i.e. That is, the speed increases.

d. Car travelling at decreasing speed

Time (s)	0	1	2	3	4	5
Distance (m)	0	45	80	105	120	125



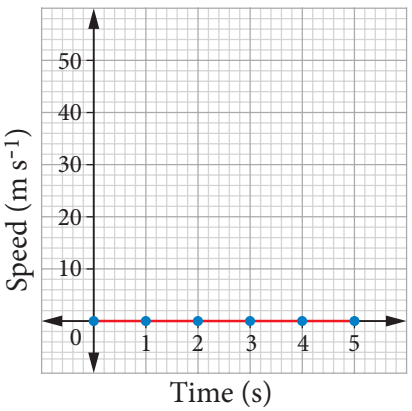
The graph has a decreasing gradient. That is, the speed decreases.

2.5 Speed – Time Graphs

Let us consider a bus travelling from Thanjavur to Trichy. The speed of the bus is measured for every second. The speed and time are recorded and a graph is plotted using the data. It is known as speed-time graph. The results for four possible journeys are shown.

a. Bus at rest

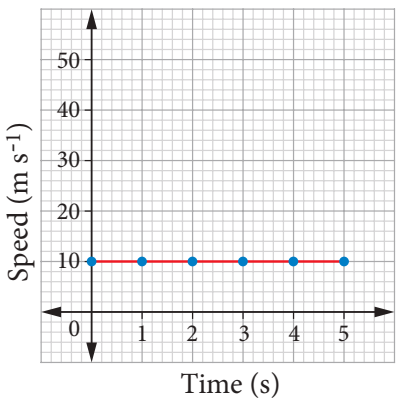
Time (s)	0	1	2	3	4	5
Speed (ms^{-1})	0	0	0	0	0	0



The speed of the bus remains at 0 ms^{-1}. So, the bus has zero acceleration.

b. Bus travelling at uniform speed of ms^{-1}

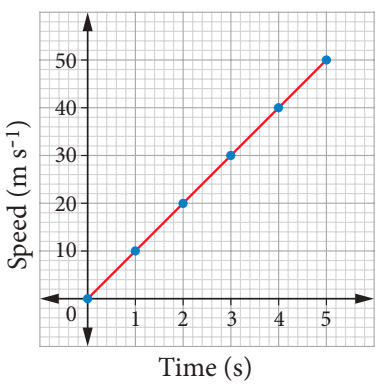
Time (s)	0	1	2	3	4	5
Speed (ms^{-1})	10	10	10	10	10	10



The speed of the bus remains at 10 ms^{-1}. Here, slope of the line is zero. So, the bus has zero acceleration.

c. Bus travelling uniform acceleration

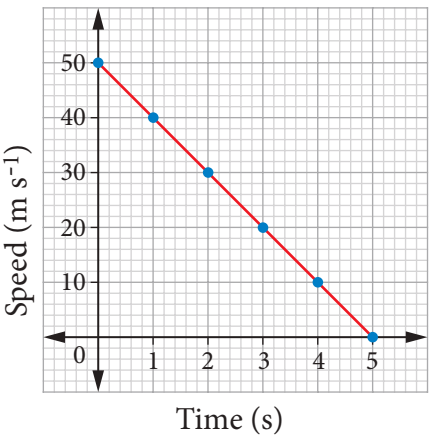
Time (s)	0	1	2	3	4	5
Speed (ms^{-1})	10	10	20	30	40	50



The speed of the bus increases by 10 ms^{-1} every second. Hence, the graph has a positive and constant gradient, and the acceleration is constant.

d. Bus travelling uniform deceleration

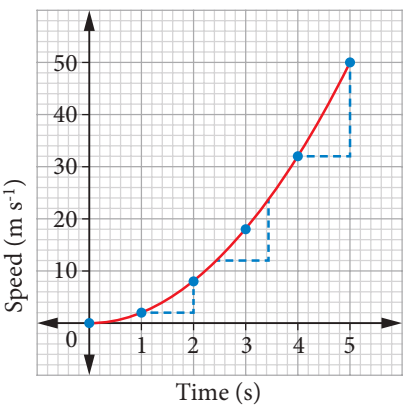
Time (s)	0	1	2	3	4	5
Speed (ms^{-1})	50	40	30	20	10	0



The speed of the bus decreases by 10 ms^{-1} very second. Hence, the graph has a negative and constant gradient and the acceleration is negative and constant.

e. Bus travelling with increasing acceleration (Non-uniform acceleration)

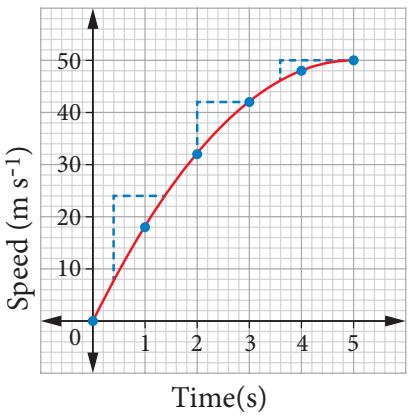
Time (s)	0	1	2	3	4	5
Speed (ms^{-1})	10	2	8	18	32	50



The speed of the bus is increasing with time. Hence, the graph has a positive and increasing gradient and the acceleration increases.

f. Bus travelling with decreasing acceleration (non-uniform acceleration)

Time (s)	0	1	2	3	4	5
Speed (ms^{-1})	10	18	32	42	48	50

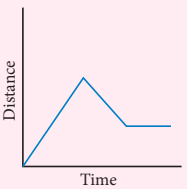


The speed is decreasing with time. Hence, the graph has a positive and decreasing gradient, and the acceleration decreases.

2.5.1 Comparison between Distance – Time and Speed – Time Graphs

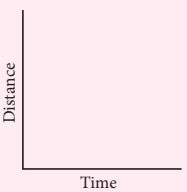
The Speed – Time graphs and Distance – Time graphs may look very similar. But, they give different information. We can differentiate them by looking at the labels.

Graph and Story



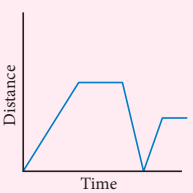
Raju began walking to his school. Suddenly he remembered that he forgot his pen and walked back home. But he stopped suddenly when he heard a noise.

Draw a graph for the given story



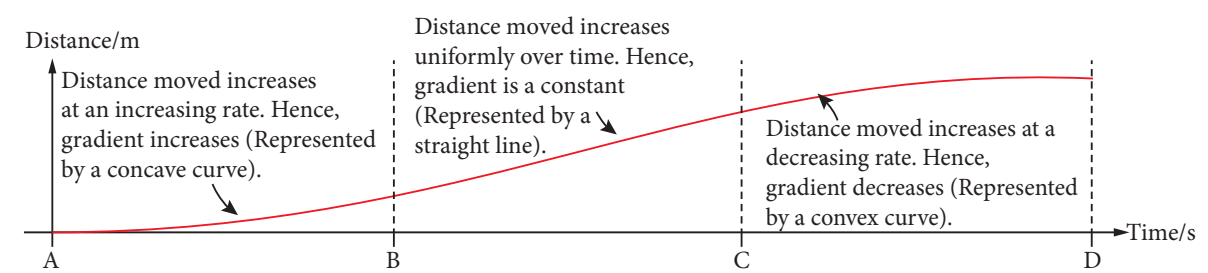
Rani was waiting for her mother for some time. When she saw her mother, she ran out of her home hugged her and stood there for a while.

Imagine and write a story on your own for the given graph?

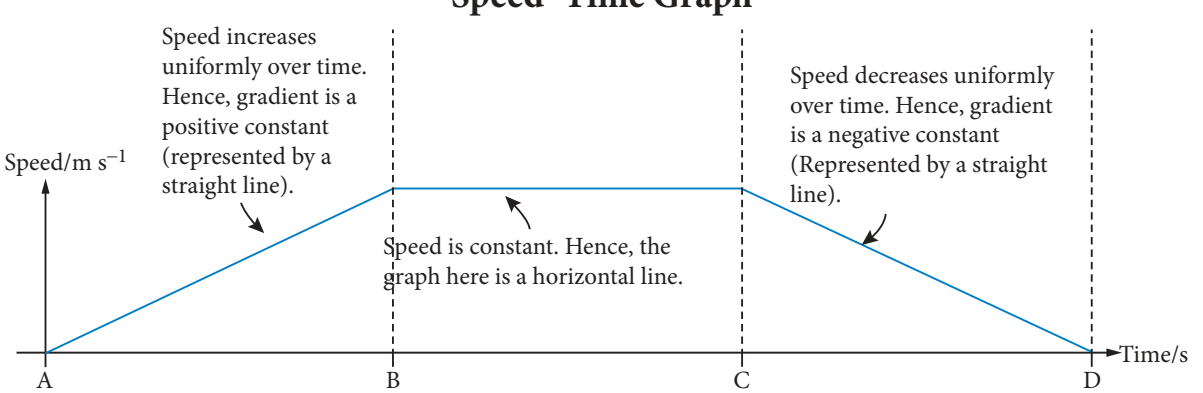


From A to B	From B to C	From C to D
Car accelerates uniformly from rest.	Car moves at constant speed.	Car decelerates uniformly to a stop.

Distance–Time Graph


Distance/m
Distance moved increases at an increasing rate. Hence, gradient increases (Represented by a concave curve).
Distance moved increases uniformly over time. Hence, gradient is a constant (Represented by a straight line).
Distance moved increases at a decreasing rate. Hence, gradient decreases (Represented by a convex curve).
Time/s
A
B
C
D

Speed–Time Graph


Speed/m s⁻¹
Speed increases uniformly over time. Hence, gradient is a positive constant (represented by a straight line).
Speed is constant. Hence, the graph here is a horizontal line.
Speed decreases uniformly over time. Hence, gradient is a negative constant (Represented by a straight line).
Time/s
A
B
C
D

2.6 Centre of Gravity

Try to balance a cardboard on your finger tip. What do you observe? You can notice that there is only one point at which the cardboard is balanced. The point at which the cardboard is balanced is called the centre of gravity of the cardboard.

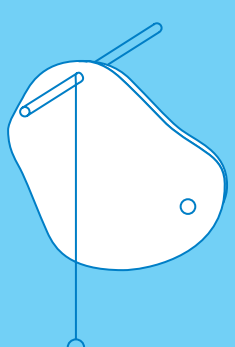
The centre of gravity of an object is the point through which the entire weight of the object appears to act. How do we find the centre of gravity of an object ?

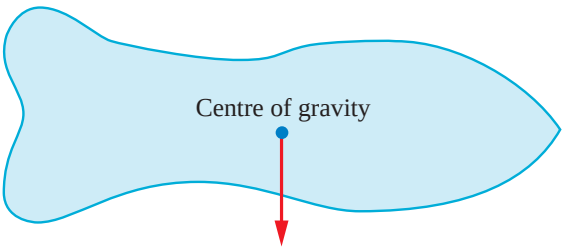
ACTIVITY 1

What about irregular shaped objects ?

Apparatus: Irregularly shaped card, string, pendulum bob, stand

1. Make three holes in the lamina.
2. Suspend the lamina from the optical pin through one of the holes as shown in figure.
3. Suspend the plumbline from the pin and mark the position of the plumbline on the lamina.
4. Draw lines on the lamina representing the positions of the plumbline.
5. Repeat the above steps for the other holes.
6. Label the intersection of the three lines as X, the position of the centre of gravity of the lamina.

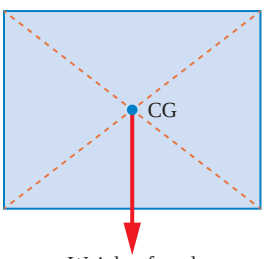




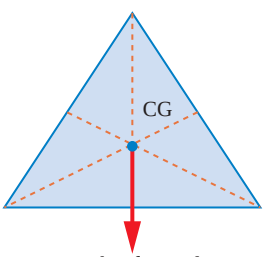
Total pull of the earth (weight) appears to act through the centre of gravity

2.6.1 Centre of gravity of regular – shaped objects

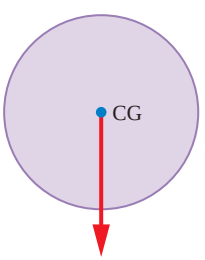
Generally the centre of gravity of the geometrical shaped objects lie on the geometric centre of the object.



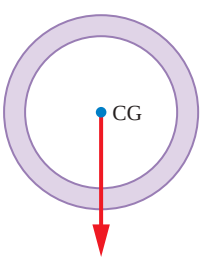
Weight of card



Weight of triangle



Weight of disc



Weight of ring

The ruler is in equilibrium when supported at its centre of gravity. For a regular object such as a uniform meter ruler, the centre of gravity is at the centre of the object. When the object is supported at that point, it will be balanced. If it is supported at any other point, it will topple.

2.7 Stability

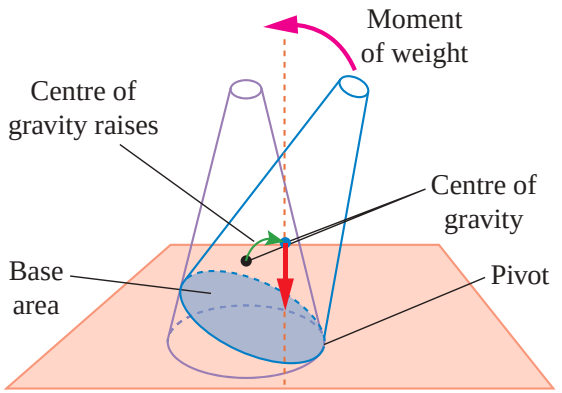
Stability is a measure of the body's ability to maintain its original position. Three types of stability are:

a. Stable equilibrium
b. Unstable equilibrium
c. Neutral equilibrium

Let us demonstrate them by taking a frustum.

Stable Equilibrium

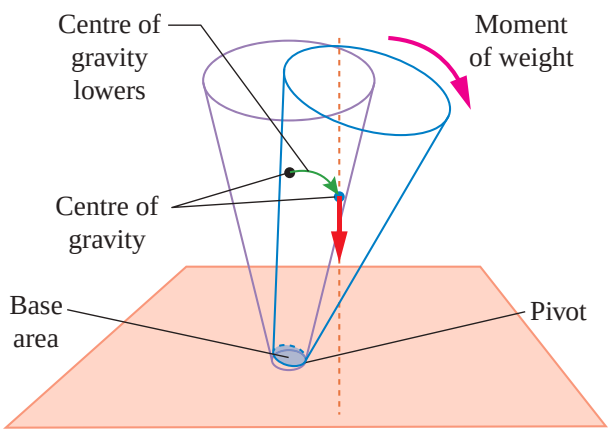
In stable equilibrium, the frustum can be tilted through quite a big angle without toppling.



Its centre of gravity is raised when it is displaced. The vertical line through its centre of gravity still falls within its base. So, it can return to its original position.

Unstable Equilibrium

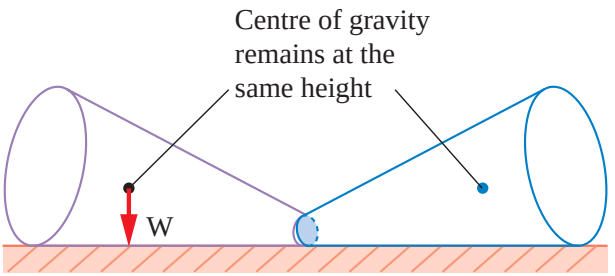
In this equilibrium, the frustum will topple with the slightest tilting. Its centre of gravity is lowered when it is displaced.



Here, the vertical line through its centre of gravity falls outside its base. So, it will not come back to its position.

Neutral Equilibrium

It causes frustum to topple. The frustum will roll about but does not topple. Its centre of gravity remains at the same height when it is displaced. The body will stay at any position to which it has been displaced.



2.7.1 Condition for Stability

Stability can be increased by the following ways.

- Lowering its centre of gravity
- Increasing the area of its base
- A heavy base lowers the centre of gravity So, the object will be stable.
- A broad base makes the object more stable.

The Thanjavur Doll

It is s type of traditional toy made in Thanjavur from terracotta material. The centre of gravity and the total weight of the doll is concentrated at its bottom most point, generating a dance-like continuous movement with slow oscillations.

2.7.2 Real Life Applications of Centre of Gravity

- In order to have stability, the luggage compartment of a tour bus is located at the bottom and not on the roof.
- Extra passengers are not allowed on the upper deck of a crowded double decker bus.

- Racing cars are built low and broad for stability.
- Table lamps and fans are designed with large heavy bases to make them stable.

Points to Remember

- ❖ The total length of a path taken by an object to reach one place from the another place is called distance.
- ❖ The shortest distance from the initial to the final position of an object.
- ❖ Acceleration is the rate of change in velocity. SI unit of acceleration is m/s^2.
- ❖ Velocity is the rate of change in displacement. SI unit of velocity is metre / second (m/s).
- ❖ The centre of gravity of an object is the point through which the entire weight of the object appears to act.
- ❖ Generally the centre of gravity of the geometrical shaped object lie on the geometric centre of the object.
- ❖ Stability is a measure of the body's ability to maintain its original position.
- ❖ The three types of stability are: stable equilibrium, unstable equilibrium, neutral equilibrium.

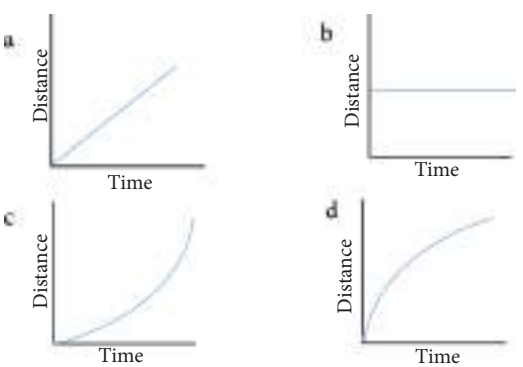
Evaluation

I. Choose the best answer.

1. A particle is moving in a circular path of radius *r*. The displacement after half a circle would be

   a. Zero b. R c. 2 *r* d. *r* / 2

2. Which of the following figures represent uniform motion of a moving object correctly?

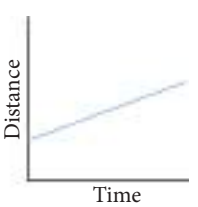


3. Suppose a boy is enjoying a ride on a merry go round which is moving with a constant speed of 10 m/s. It implies that the boy is

   a. at rest
   b. moving with no acceleration
   c. in accelerated motion
   d. moving with uniform velocity

4. From the given v-t graph it can be inferred that an object is

   a. in uniform motion b. at rest
   c. in non - uniform motion
   d. moving with uniform accelerations



5. How can we increase the stability of an object?

   a. Lowering the centre of gravity
   b. Raising the centre of gravity
   c. Increasing the height of the object
   d. Shortening the base of the object

II. Fill in the blanks.

1. The shortest distance between two places is _____.
2. The rate of change of velocity is_____.

3. If the velocity of an object increases with respect to time, then the object is said to be in_____ acceleration.
4. The slope of the speed–time graph gives _____.
5. In _____ equilibrium, the centre of gravity remains at the same height when it is displaced.

III. Match the following.

Displacement	Knot
Light travelling through vacuum	Geometric centre
Speed of ship	Metre
Centre of gravity of geometrical shaped objects	Larger base area
Stability	Uniform velocity

IV. Analogy

1. Velocity : metre/second :: Acceleration : _____ .
2. Length of scale : metre :: Speed of aeroplane : _____ .
3. Displacement / Time : Velocity :: Speed / Time : _____ .

V. Answer very briefly.

1. Asher says all objects having uniform speed need not have uniform velocity. Give reason.
2. Saphira moves at a constant speed in the same direction. Rephrase the same sentence in fewer words using concepts related to motion.
3. Correct your friend who says that acceleration gives the idea of how fast the position changes.

VI. Answer briefly.

1. Show the shape of the distance – time graph for the motion in the following cases.
   a. A bus moving with a constant speed.
   b. A car parked on a road side.
2. Distinguish between speed and velocity.
3. What do you mean by constant acceleration?
4. What is centre of gravity ?

VII. Answer in detail.

1. Explain the types of stability with suitable examples.
2. Write about the experiment to find the centre of gravity of the irregularly shaped plate.

VIII. Numerical problems.

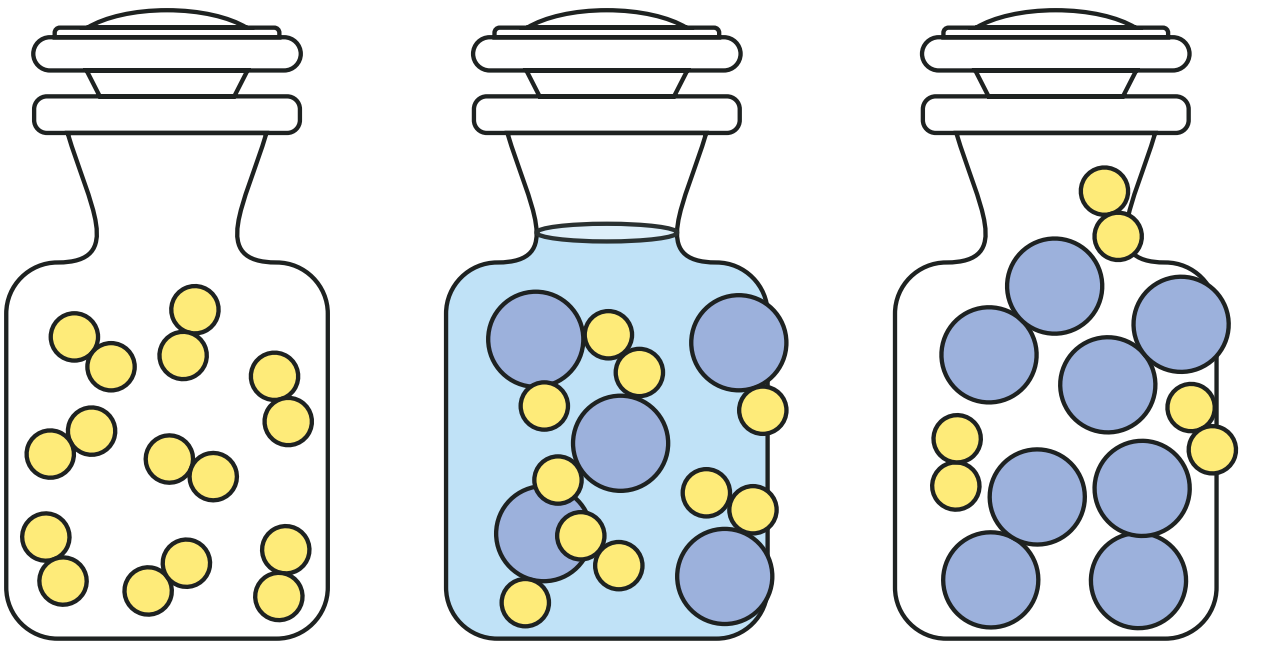
1. Geetha takes 15 minutes from her house to reach her school on a bicycle. If the bicycle has a speed of 2 m/s, calculate the distance between her house and the school.
2. A car starts from rest and it is travelling with a velocity of 20 m/s in 10 s. What is its acceleration?
3. A bus can accelerate with an acceleration of 1 m/s^2. Find the minimum time for the bus to attain the speed of 100 km/s from 50 km/s.

IX. Fill in the boxes.

S.No.	First Move	Seconde Move	Distance (m)	Displacement
1.	Move 4 metres east	Move 2 metres west	6	2 m east
2.	Move 4 metres north	Move 2 metres south		
3.	Move 2 metres east	Move 4 metres west		
4.	Move 5 metres east	Move 5 metres west		
5.	Move 5 metres south	Move 2 metres north		
6.	Move 10 metres west	Move 3 metres east		

Unit 3

Matter Around Us



Element (Hydrogen) **Compound (Water)** **Mixture (Hydrogen & Oxygen)**

Learning Objectives

After studying this unit, students will be able to:

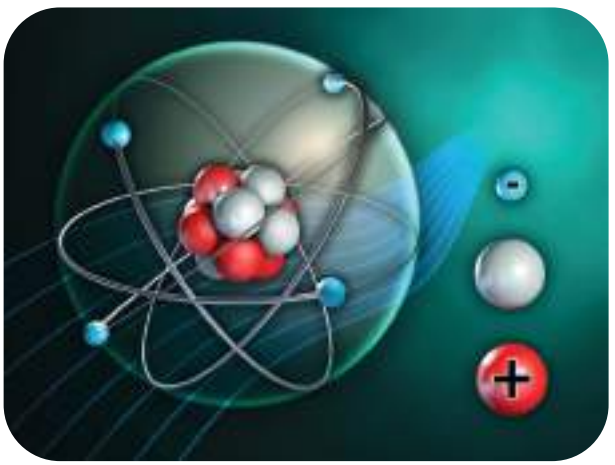
- know about the molecules of elements and compounds.
- write the symbols of common elements.
- calculate the atomicity of commonly used elements.
- know about the occurrence of elements and compounds in nature and human body / air.
- understand the effects of temperature on solid, liquid and gas.

Introduction

We know that everything that occupies space and has mass is called matter. Do you know what is matter is composed of? We have studied earlier that matter is composed of tiny little particles, which cannot be seen with naked eye. That particle is called atom. In this lesson, we will study about atoms, molecules, elements, compounds, chemical formulae and atomicity.

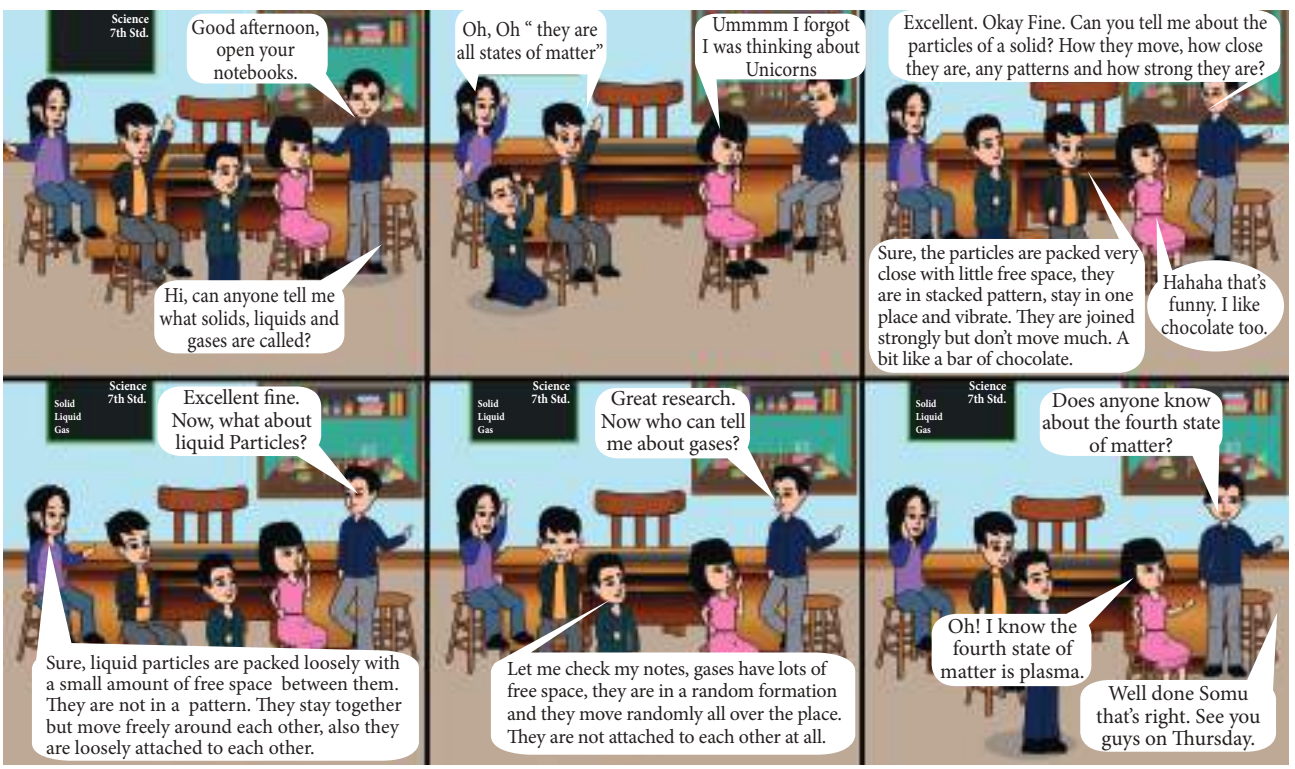
3.1 Atoms

Graphite lead used in pencil is made up of an element called carbon. We can break graphite into smaller and smaller pieces. If we have a finer knife, we can break it even smaller. If we keep cutting the minuscule graphite into smaller and smaller particle, we will reach a point where we get the smallest constituent of graphite - carbon atom. If we break the carbon atom apart, the properties of carbon are exhibited. The smallest unit of an element that exhibits the properties of that element is called as 'atom'. All the matter is composed of tiny particles called atom. Water, rice and everything we see around is made up of atoms. An atom is the basic unit of a matter.



Structure of an atom

Even with the best of optical microscope we cannot see atoms. However, there are advanced instruments that help us to imagine the atoms on the surface of a material. For example, the following figure shows the image of the surface of silicon.


Science 7th Std.
Good afternoon, open your notebooks.
Hi, can anyone tell me what solids, liquids and gases are called?
Oh, Oh " they are all states of matter"
Ummmm I forgot I was thinking about Unicorns
Excellent. Okay Fine. Can you tell me about the particles of a solid? How they move, how close they are, any patterns and how strong they are?
Sure, the particles are packed very close with little free space, they are in stacked pattern, stay in one place and vibrate. They are joined strongly but don't move much. A bit like a bar of chocolate.
Hahaha that's funny. I like chocolate too.
Solid Liquid Gas
Excellent fine. Now, what about liquid Particles?
Sure, liquid particles are packed loosely with a small amount of free space between them. They are not in a pattern. They stay together but move freely around each other, also they are loosely attached to each other.
Great research. Now who can tell me about gases?
Let me check my notes, gases have lots of free space, they are in a random formation and they move randomly all over the place. They are not attached to each other at all.
Does anyone know about the fourth state of matter?
Oh! I know the fourth state of matter is plasma.
Well done Somu that's right. See you guys on Thursday.

Surface of Silicon

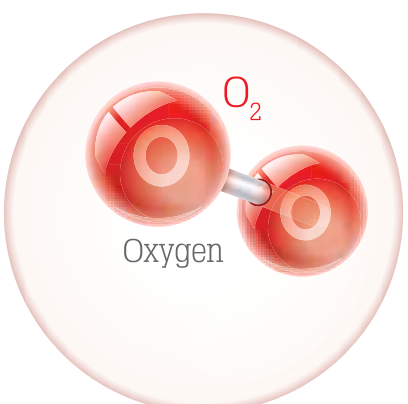
The most abundant atom in the universe is the hydrogen atom. Nearly 74% of the atoms in the universe are hydrogen atoms. However, three most abundant atoms on the Earth are iron, oxygen and silicon.

3.2 Molecules

When an atom combines with another atom (or atoms) and forms a compound, it is called as molecule. *A molecule is made up of two or more atoms chemically combined.*

OX397

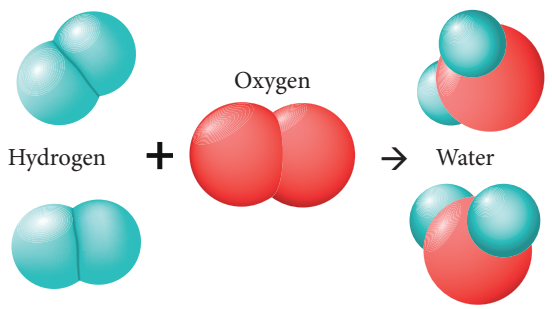
Oxygen gas in the air that we breathe is made up of two oxygen atoms chemically combined.



Ozone is a substance that is made up of three oxygen atoms chemically combined.

An atom of oxygen (O) and two atoms of hydrogen (H) combine to form a molecule of water (H_2O).

$$2H_2 + O_2 \rightarrow 2H_2O$$



Formation of water molecule

Molecules exhibit the properties of matter and also have individual existence. A molecule can be formed by the same or different kinds of atoms.

Molecules can be classified as below.

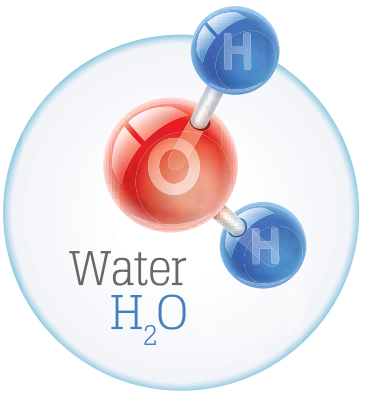
- A molecule which contains only one atom is called monatomic molecule (Inert gases).
- A molecule which contains two atoms is called diatomic molecule (Oxygen, Nitric oxide, Hydrogen, etc.).
- A molecule containing three atoms is called a triatomic molecule (Ozone, Sulphur dioxide, Carbon dioxide, etc.).
- A molecule containing more than three atoms is known as polyatomic molecule (Phosphate, Sulphur, etc.).

3.2.1 Molecules of Elements

A molecule of an element consists of fixed number of one types of atom chemically combined. Table 3.1 shows that gases are made up of two atoms of the same element.

3.2.2 Molecules of Compounds

Molecule of a compound consists of a fixed number of different types of atoms chemically combined. For example, let us look at the model of a water molecule below. Each molecule of water consists of one oxygen atom and two hydrogen atoms. The ratio of oxygen and hydrogen atoms remains fixed whether water is in liquid, solid or gaseous state. This principle applies to the molecules of all compounds. Compounds with different atoms are given in Table 3.2.



Model of water molecule

Bismuth in diarrhea medicine

Bismuth is an element that occurs naturally. It is combined with other elements to make medicine for treating diarrhea.

Table 3.1 Compounds with same atoms

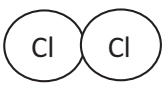
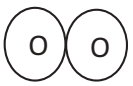
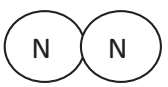
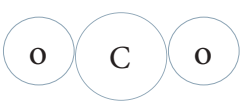
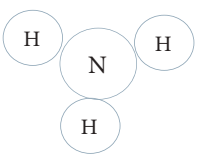
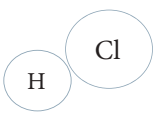
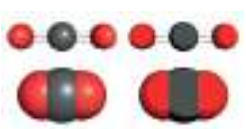
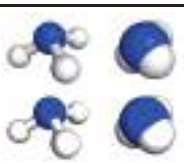
Molecule	Chlorine Gas	Oxygen Gas	Nitrogen Gas
Molecule Diagram			
Molecule Model (Ball-and-Stick)	Chlorine Molecule	Oxygen Molecule	Nitrogen Molecule

Table 3.2 Compounds with different atoms

Molecule	Carbon dioxide	Ammonia	Hydrogen Chloride
Molecule Diagram			
Molecule Model (Ball-and-Stick)	 Carbon-dioxide Molecule	 Ammonia Molecule	Hydrogen Chloride

3.3 Elements

Matter is classified into two broad categories, namely, pure substances and mixtures. Pure substances are further divided into two categories as elements and compounds.

Matter in its simplest form is called an element. We are using many elements in our daily life. The common salt consists of two elements, sodium and chlorine. Water consists of hydrogen and oxygen. Magnesium and phosphorus are used for making crackers. Sulphur is used as manure in agriculture. Gallium is used for making mobile phones and silicon is used for making computer chips.

There are 118 known elements till date. Out of these, 94 elements occur naturally while 24 elements are synthesised artificially in the laboratory.

3.3.1 Classification of Elements

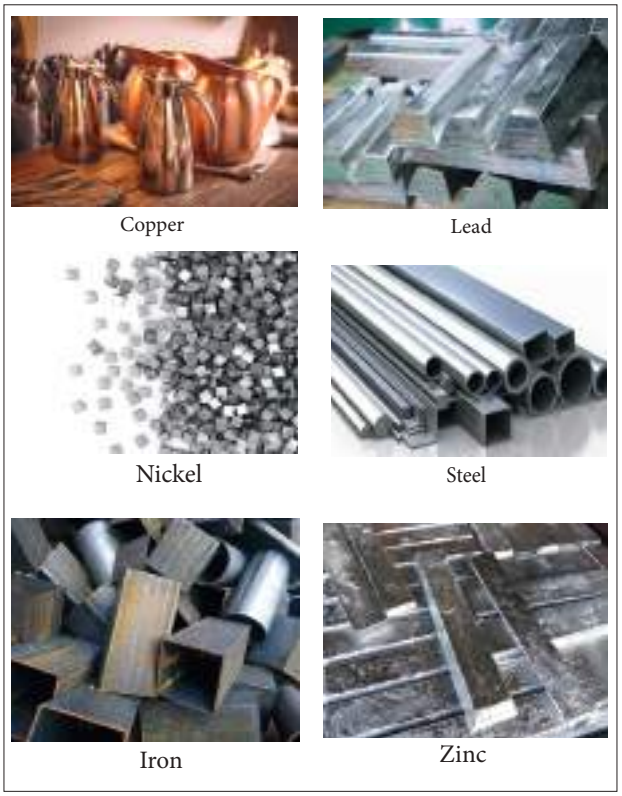
We can classify the elements broadly into metals, non-metals and metalloids based on their chemical properties.

Robert Boyle is the first scientist who used the term element. He is the early proponent of the elemental nature of matter and the nature of vacuum. He is known best for Boyle's Law.

Metals

We have tools, utensils and jewellery made of silver, copper, iron, gold, aluminium, etc. By hammering or rolling we can deform these materials into various shapes. Such elements that are malleable (a material may be flattened into thin sheets or various shapes) are called as metals.

Metals are generally hard and shiny elements. Sodium is one of the exceptions as it is soft. All metals, except mercury are solids at room temperature. Mercury is the only metal that is liquid at room temperature. Metals are malleable, can be bent or beaten into sheets. They can be drawn into wires. They are good conductors of heat and electricity. Copper, lead, tin, nickel, iron, zinc, gold, magnesium and calcium are examples of metals.



Metals

Non-metals

Non-metals are generally dull and soft. However, diamond is shiny and also the hardest natural substance on earth. Non-metals can be gases, solids and liquids. Non-metals such as oxygen, hydrogen and chlorine are gases at room temperature. Carbon, iodine, sulphur and phosphorus are solids at room temperature. Bromine is the only non-metal that is liquid at room temperature. Non-metals are poor conductors of heat and electricity. However, graphite (a form of the non-metal carbon) is a good conductor of electricity.

Phosphorus

Sulpher

Non - metals

Table 3.3 Difference between metals and non-metals

Metals	Non-Metals
Metals are lustrous. They have a shiny surface.	Non metals are non lustrous. They have non- shiny surface.
Metals are generally hard.	Non-metals are generally soft.
Most metals can be bent, beaten into sheets and they can be drawn into wires.	Non-metals can not be bent, beaten into sheets and they can not be drawn into wires.
Most metals are good conductors of electricity.	Non-metals are bad conductors of electricity.
Most metals are good conductors of heat.	Non-metals are bad conductors of heat.
Most metals make ringing sound when struck. Hence, they are used to make objects like bells.	Non-metals does not make any sound when they are struck.

Metalloids

Metalloids exhibit the properties of both metals and non metals. Silicon, arsenic, antimony, and boron are some examples of metalloids.

Boron (B)

Silicon (Si)

Germanium (Ge)

Arsenic (As)

Antimony (Sb)

Tellurium (Te)

Metalloids

3.3.2 Symbol of an element

A symbol is an abbreviation or short representation of a chemical element. There is a unique symbol for each element. It represents one atom of the element. The symbol is usually derived from the name of the element, which is either in English or Latin. These symbols are accepted by the International Union of Pure and Applied Chemistry (IUPAC).

Dalton was the first scientist to use the symbols for elements in a very specific sense. When he used a symbol for an element he also meant a definite quantity of that element, that is, one atom of that element. Berzelius suggested that the symbols of elements can be written as one or two letters of the name of the element.

The following rules are followed while assigning symbol to an element.

In the beginning, the names of elements were derived from the name of the place where they were found for the first time. For example, the name copper was taken from Cyprus. Some names were taken from specific colours. For example, gold was taken from the English word meaning yellow. Now-a-days, IUPAC approves names of elements. Many of the symbols are the first one or two letters of the element's name in English. The first letter of a symbol is always written as a capital letter (uppercase) and the second letter as a small letter (lowercase).

ACTIVITY 1

Find out the symbols of the elements with the help of your teacher.

Elements	Symbol
Gold	
Silver	
Copper	
Iron	
Nitrogen	
Oxygen	
Aluminium	
Calcium	
Phosphorus	
Magnesium	
Potassium	
Sodium	

- Chemical symbols usually consist of one or two letters.
- The symbols of most elements correspond to the first letter (which is capitalized) of their English name. For example, the symbol for oxygen is O and that for hydrogen is H. You will study about symbols in details in standard 8.

3.3.3 Elements in human Body

Nearly 99% of the mass of our human body consists of just six chemical elements namely, oxygen, carbon, hydrogen, nitrogen, calcium, and phosphorus. Another five elements make up most of the least percentage. They are potassium, sulphur, sodium, chlorine, and magnesium.

3.3.4 Elements in air

Air is a mixture of gases. The molecules of two different elements, nitrogen and oxygen, make up about 99% of the air. The rest includes small amounts of argon and carbon dioxide. Other gases such as neon, helium, and methane are present in trace amounts. Oxygen is the life-giving element in the air.

3.4 Compounds

A compound is a pure substance that is formed when the atoms of two or more elements combine chemically in definite proportions.

Compounds exhibit properties that are entirely different from the properties of their constituent elements. For example, the atoms of the elements hydrogen and oxygen combine chemically in a fixed ratio to form the compound water. However, water does not have the same properties of hydrogen and oxygen. For example, at room temperature water exists as liquid while hydrogen and oxygen exist as gases. Also, oxygen supports fire whereas water is used as a fire extinguisher.

Similarly, common salt (Sodium chloride) is a compound made up of elements sodium and chlorine. It is used in our food, whereas sodium and chlorine are poisonous, and both are unsafe for consumption.

Sodium is a highly reactive solid at room temperature . It burns vigorously when in contact with water

+

Chlorine is yellowish green poisonous gas at room temperature

→

Sodium Chloride (Used for cooking)

Chalk (Calcium, Carbon and Oxygen)

Sugar (Carbon, Hydrogen and Oxygen)

3.4.1 Properties of Compounds

- A compound is formed only when the constituent elements combine in a fixed proportion.
- The properties of a compound are different from those of its constituent elements.
- A compound cannot be broken down by physical methods. This is because a compound is made up of different elements that are chemically combined. Sodium chloride cannot be separated by physical methods such as filtration.
- A compound can be separated into its constituent elements by chemical methods only.

ACTIVITY 2

Complete the following table.

Compound	Constituent Elements
Water	
Salt (Sodium chloride)	
Sodium carbonate	
Baking soda (sodium bicarbonate)	
Sugar	
Calcium oxide	
Calcium hydroxide	
Sodium hydroxide	
Potassium hydroxide	

ACTIVITY 3

Complete the following table.

Formula	No. of different elements	Name of Elements
H_2O	H – 2 O – 1	Hydrogen, Oxygen
NaCl		
$C_6H_{12}O_6$		
NaOH		

Table 3.4 Difference between an element and a compound

Elements	Compounds
An element is the simplest substance.	A compound is a chemical substance formed by the combination of two or more elements.
Elements combine to form compounds.	Compounds can be split into elements.
Atoms are the fundamental particles of an element.	Molecules are the fundamental particles of a compound.

3.5 Chemical Formulae

Often we write water as H_2O. This is the chemical formula for water molecule. This means that each molecule of water has two hydrogen atoms combined with one oxygen atom. A chemical formula is a symbolic representation of one molecule of an element or a compound. It provides information about the elements present in the molecule and the number of atoms of each element. In H_2O, small number beside the 'H' is called subscript. It tells us the number of atoms of that element present in the molecule. Hence, there are two hydrogen atoms in water molecule. There is no number of besides 'O'. It means that there is only one atom of that element present in the molecule. Hence, there is 1 oxygen atom in a water molecule. Can you guess the types of atoms and number of each of the atoms in sodium chloride? Which is the chemical formula for cooking salt?

Here are some examples of chemical formula.

Sodium Chloride (Nacl) : 1 atom of Sodium and 1 atom of chlorine

Ammonia (NH_3) : 1atom of Nitrogen and 3 atoms of Hydrogen

Glucose ($C_6H_{12}O_6$) : 6 Carbon atoms, 12 Hydrogen atoms and 6 Oxygen atoms

The chemical formula tells us the types of atoms and the number of each type of atom in one molecule of substance.

Table 3.5 Common compounds and their chemical formula

Names	Formula
Water	H_2O
Glucose	$C_6H_{12}O_6$
Salt	NaCl
Ethanol	C_2H_5OH
Ammonia	NH_3
Sulphuric Acid	H_2SO_4
Methane	CH_4
Sucrose	$C_{12}H_{22}O_{11}$

3.6 Atomicity

In chemistry, atomicity implies the total number of atoms present in one molecule of an element, compound or a substance. Let us see how to calculate the atomicity of elements. For example, oxygen exists as a diatomic molecule. It means that a molecule of oxygen contains two atoms hence its atomicity is 2.

$$O + O \longrightarrow O_2$$

Oxygen atom + Oxygen atom ⟶ Oxygen Molecule

Similarly a phosphorus molecule (P_4) contains 4 atoms and a sulphur molecule (S_8) contains 8 sulphur atoms. Hence, their atomicity is 4 and 8 respectively.

For molecule containing more than one types of atoms, simply count the number of each atom and that would be its atomicity. For example, one molecule of sulphuric acid (H_2SO_4) consists of 2 hydrogen atom, 1 sulphur atom and 4 oxygen atoms. Hence, its atomicity is 7(2+1+4).

One molecule of water (H_2O) contains two atoms of hydrogen and one atom of oxygen. Thus, the atomicity of water is three.

Table 3.6 Atomicity of some elements

Element	Atomicity	Elements	Atomicity
H	2	F	2
He	1	Ne	1
Li	1	Na	1
Be	1	Mg	**1**
N	2	P	4
O	2	S	8

ACTIVITY 4

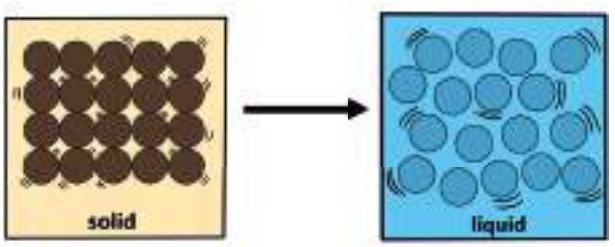
Write down the atomicity of the following elements and compounds

Elements / Compounds	Atomicity
Cl	
Na	
K	
Ca	
H_2O	
Nacl	

3.7 Effect of temperature on Solid, Liquid and Gas

In solids, particles are arranged very closely. When solids are heated, the particles in them gain energy and vibrate vigorously. They move slightly further apart from one another. This causes the volume of matter to increase. This process is called expansion. How it happens?

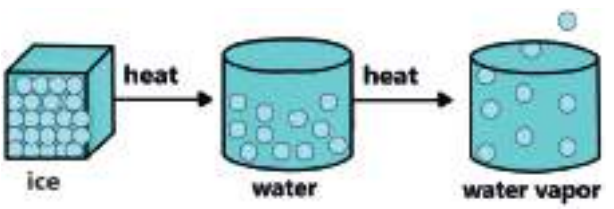
The matter begins to expand when heated and the volume increases due to the increase in the distance between the particles. But, the size of the particles remains same.



How do hot-air balloons float? When air inside the hot air balloon is heated with a burner, it expands. The expansion causes the density of the air inside the balloon to decrease. Hence, the air inside the balloon has a lower density than the air outside the balloon. This difference in density allows the hot-air balloon to float.

During heating or expansion, the mass of matter does not change. Although the volume of the matter changes, the size and number of the particles of matter do not change. Hence, during heating, the mass of matter is conserved. For example, in an iron lock the distance between the iron particles increases when they gain enough heat. However, the number of iron particles does not change. Hence, the mass of the iron lock is conserved.

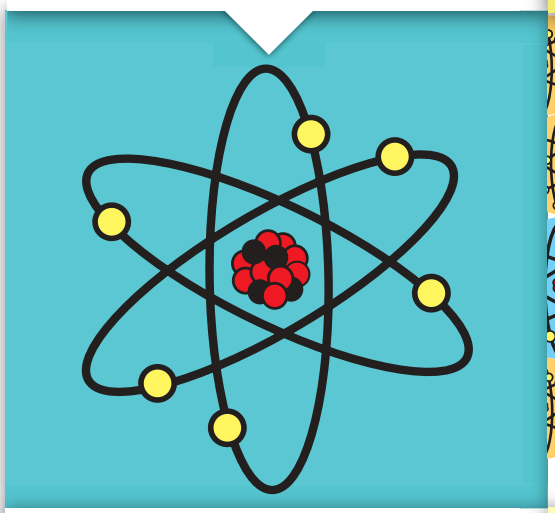
The melting of ice is an example for change of states of matter. The change in the states of matter occurs during melting, boiling and freezing and condensation. When the particles possess enough energy, they overcome the strong forces of attraction between one another. They break free from one another and move randomly. For example, when solid ice is heated to 0^0C, it melts to become liquid water. In the same way, when liquid water is heated to 100^0C, it boils to become steam.



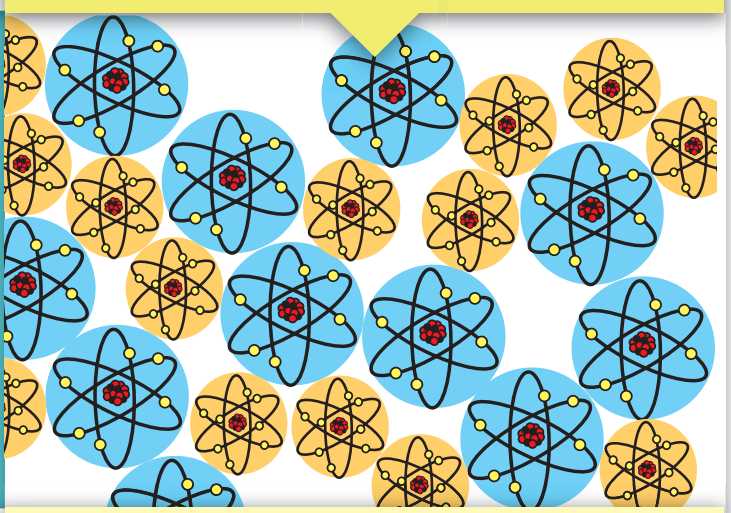
1. Solid
When solid is heated, the particles gain energy and vibrate more vigorously
2. Liquid
When the melting point is reached melting occurs. The solid changes to its liquid state.
When a liquid is heated the particles gain energy and vibrate more vigorously.
3. Gas
Boiling occurs when the boiling point is reached. The liquid changes to its gaseous state.

Configuration of Matter

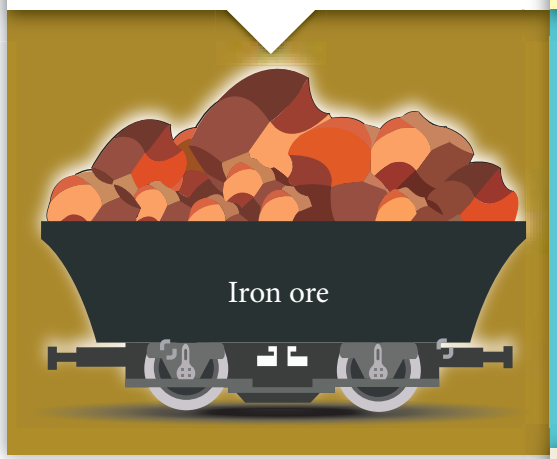
ATOM
Smallest particle of an Element



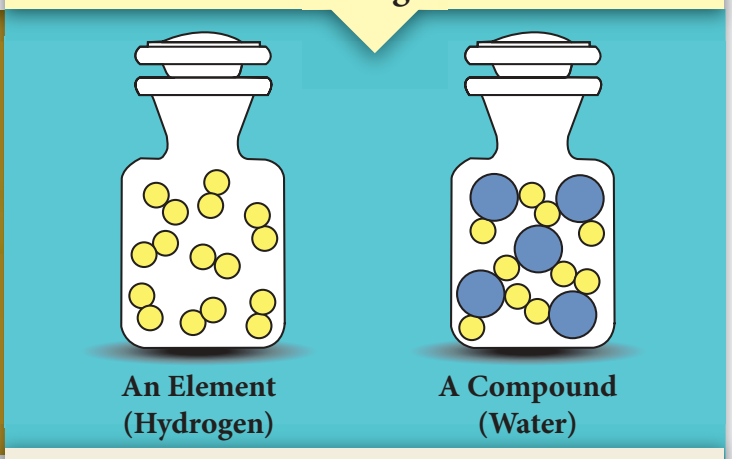
MOLECULE
Atoms makes molecules



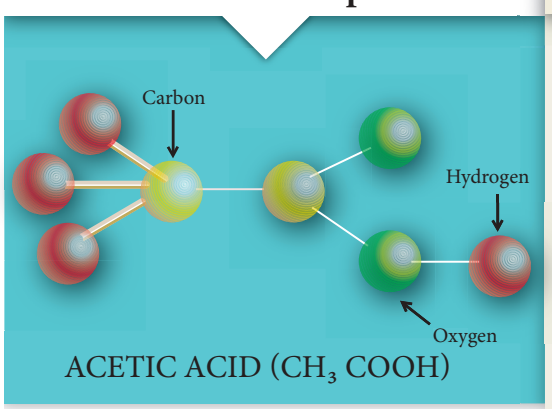
ELEMENT
Chemically simplest substance which cannot be broken down



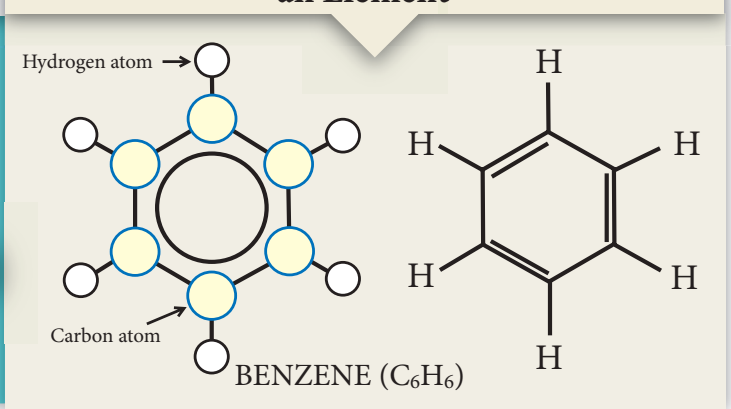
COMPOUND
Two or more elements which are chemically bonded together



CHEMICAL FORMULA
Tells the number of atoms of an element in a compound



CHEMICAL SYMBOL
Short representation of an Element



Points to Remember

- ❖ Elements are the simplest forms of pure substances.
- ❖ Molecules of an element consist of a fixed number of one type of atom.
- ❖ Molecules of a compound consist of a fixed number of different types of atom.
- ❖ The molecules of the elements nitrogen and oxygen make up 99 percent of the air.
- ❖ An atom is the smallest particle of an element.
- ❖ The particulate nature of matter can be used to explain heating effect of solid, liquid and gas.
- ❖ The mass of the matter remains same during expansion.
- ❖ A molecule is made up of two or more atoms chemically combined.
- ❖ We can represent a molecule using chemical formula.

Evaluation

2JUNW

I. Choose the appropriate answer.

1. Which one of the following is an example for a metal?
   a. Iron b. Oxygen c. Helium d. Water
2. Oxygen, hydrogen, and sulphur are examples for
   a. metals b. non-metals
   c. metalloids d. inert gases
3. Which of the following is a short and scientific way of representing one molecule of an element or compound?
   a. Mathematical formula
   b. Chemical formula
   c. Mathematical symbol
   d. Chemical symbol
4. The metal which is liquid at room temperature is
   a. chlorine b. sulphur
   c. mercury d. silver
5. An element which is always lustrous, malleable and ductile is
   a. non-metal b. metal c. metalloid d. gas

II. Fill in the blanks.

1. The smallest particle of matter that can exist by itself is _____.
2. A compound containing one atom of carbon and two atoms of oxygen is _____.
3. _____ is the only non-metal which conducts electricity.
4. Elements are made up of _____ kinds of atoms.
5. _____ of some elements are derived from Latin or Greek names of the elements.
6. There are _____ number of known elements.
7. Elements are the _____ form of pure substances.
8. The first letter of an element is always written in _____ letter.
9. Molecule containing more than three atoms are known as_____.
10. _____ is the most abundant gas in the atmosphere.

III. Analogy.

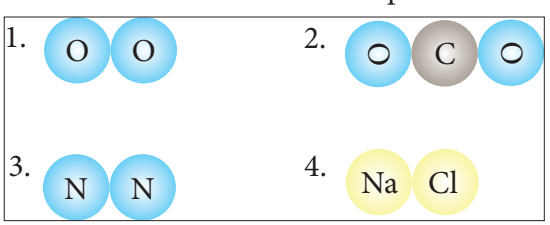
1. Mercury : Liquid at room temperature :: Oxygen: _____.
2. Non-metal conducting electricity : _____ :: Metal conducting electricity : Copper
3. Elements : Combine to form compounds :: Compounds :_____.
4. Atoms : Fundamental particle of an element :: _____ : Fundamental particles of a compound.

IV. State true of false. If false, give the correct statement.

1. Two different elements may have similar atoms.
2. Compounds and elements are pure substances.
3. Atoms cannot exist alone. They can only exist as groups called molecules.
4. NaCl represents one molecule of sodium chloride.
5. Argon is mono atomic gas.

V. Answer in brief.

1. Write the chemical formula and name the elements present in the following compounds.
   a. Sodium chloride
   b. Potassium hydroxide
   c. Carbon dioxide
   d. Calcium oxide
   e. Sulphur dioxide
2. Classify the following molecules as the molecules of element or compound.



3. What do you understand by chemical formula of a compound? What is its significance?
4. Define the following terms with an example for each.
   a. Element
   b. Compound
   c. Metal
   d. Non-metal
   e. Metalloid
5. Write the symbols for the following elements and classify them as solid, liquid and gas.
   Aluminum, Carbon, Chlorine, Mercury, Hydrogen and Helium
6. Classify the following as metals, non-metals and metalloids.
   Sodium, Bismuth, Silver, Nitrogen, Silicon, Carbon, Chlorine, Iron, Copper
7. Classify the following as elements and compounds.
   Water, Common salt, Sugar, Carbon dioxide, Iodine and Lithium
8. Write the chemical formula for the following elements.
   a. Hydrogen b. Nitrogen
   c. Ozone d. Sulphur
9. What are elements? What are they made of? Give two examples.
10. Define molecule.
11. What are compounds? Give two examples.
12. Give an example for the elements derived from their Latin names.
13. What is atomicity of elements?
14. Calculate the atomicity of H_2SO_4.

VI. Answer in detail.

1. Differentiate metals and non-metals.
2. Explain the characteristics of compounds
3. Describe the different ways in which we can write the symbols of elements. Give appropriate examples.

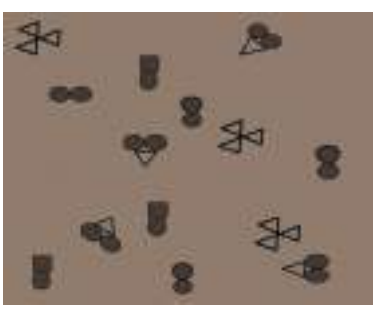
4. Differentiate between elements and compounds.
5. Write any five characteristics of compounds.
6. Compare the properties of metals and non-metals. Give three examples for each.
7. Write down the properties of metalloids.

VII. Rewrite the given sentence in correct form.

1. Elements contain two or more kind of atoms and compounds contain only one kind of atom.

VIII. Higher Order Thinking Skills.

1. List out the metals, non-metals and metalloids which you use in your house, schools. Compare their properties.
2. What changes take place in the movement and arrangement of particles during heating process?
3. In the diagram given below, the circle, square and triangle represent the atoms of different elements.



Identify all combinations that represent

a. molecule of a compound
b. molecule of an element consisting of two atoms
c. molecule of an element consisting of three atoms

4. Aakash noticed that the metal latch on gate was difficult to open during hot sunny days. However, it was not difficult to open the same latch at night. Aakash observed that the latch and the gate are exposed to the sun during day time.

   a. Formulate a hypothesis based on the information provided.

   b. Briefly state how you would test the hypothesis.

IX Consider the following statements and choose the correct option.

1. **Assertion:** Oxygen is a compound.
   Reason: Oxygen cannot be broken down into anything simpler.
2. **Assertion:** Hydrogen is an element.
   Reason: Hydrogen cannot be broken down into anything simpler.
3. **Assertion:** Air is a compound.
   Reason: Air consists of carbon dioxide.
4. **Assertion:** Air is a mixture of elements only.
   Reason: Only nitrogen, oxygen and neon gases exist in air.
5. **Assertion:** Mercury is solid in room temperature.
   Reason: Mercury is a non-metal.

   a. Both assertion and reason are true and reason is the correct explanation of assertion.
   b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
   c. Assertion is true but reason is false.
   d. Assertion is false but reason is true.

ICT CORNER

Matter around us

Let's build the molecules.

PROCEDURE :

Step 1: Use the URL to reach stimulation page. Click 'Download' and launch the stimulation.

Step 2: Drag the atoms from the kit which is at the bottom of the display to 'make molecule'. Click on "3D" to see the molecule in 3 dimension. And drag that molecule to 'Your molecule collection' on the left side window.

Step 3: Click on the 'collect multiple' tab on the top of the window for more molecules.

Step 4: Click on the 'Larger molecules' tab to make larger molecules.

Step 1

Step 2

Step 3

Step 4

Matter around us URL:

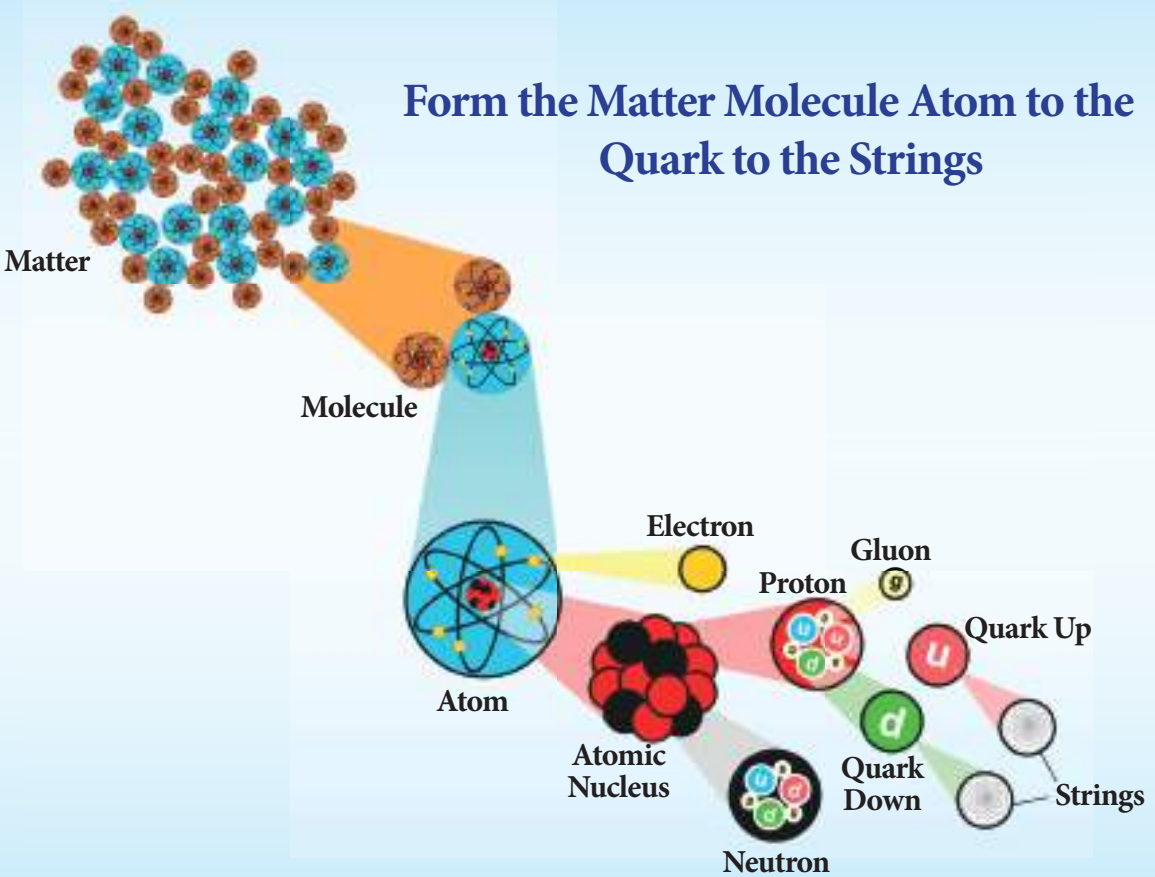
https://phet.colorado.edu/en/simulation/build-a-molecule

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.

Unit 4

Atomic Structure



Learning Objectives

After studying this unit, students will be able to:

- ❖ know the structure of an atom.
- ❖ know the position of the sub-atomic particles.
- ❖ understand and compare the properties of sub-atomic particles.
- ❖ understand the terms atomic number and mass number.
- ❖ calculate the number of protons, electrons and neutrons in an atom from the symbols given in the periodic table.
- ❖ understand the term valency.

Introduction

In the last chapter we studied that anything around us is matter and it is made up of molecules. The molecules are combination of atoms of different elements or the same element. Table, chair, bag, book, chalk and blackboard, in short everything you see around are made up of atoms. Atoms are the smallest particles. They cannot be seen even through a microscope. In this lesson, we are going to study about atomic theories, sub-atomic particles, atomic number and mass number and valency.

4.1 Atomic Theories

An atom is thousand times smaller than the thickest human hair. It has an average diameter of 0.000000001 m or 1×10^{-9} m. To understand the size of an atom, now let us find what is the size of known things like pencil, red blood cell, virus and dust particle.

Pencil (1×10^{-2} m)

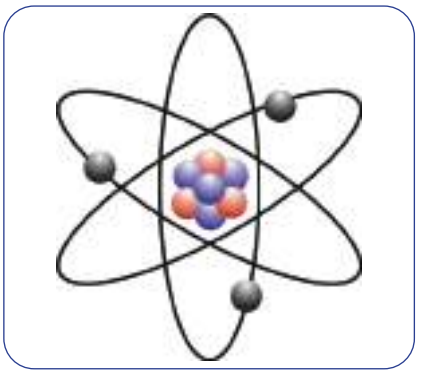
Red Blood Cell (1×10^{-4} m)

Virus (1×10^{-6} m)

Dust Particle (1×10^{-7} m)

Now you could imagine how small an atom would be.

Many scientists have studied the structure of the atom and advanced their theories about it. The theories proposed by Dalton, Thomson and Rutherford are given below.



Atom (1×10^{-10} m)

4.1.1 Dalton's atomic theory

John Dalton

John Dalton proposed an atomic theory in the year 1808. He proposed that matter consists of very small particles which he named atoms. An atom is the smallest indivisible particle. It is spherical in shape. His theory does not propose anything about the positive and negative charges of an atom. Hence, it was not able to explain many of the properties of substances.

Nanometer is the smallest unit used to measure small lengths. One nanometer is equal to 1×10^{-9} m.

4.1.2 Thomson's theory

J.J. Thomson

In 1897 J.J Thomoson proposed a different theory. He compared an atom to a watermelon. His theory proposed that an atom has positively charged part like the red part of the watermelon and in it are embedded, like the seeds, negatively charged particles

ACTIVITY 1

Some known objects and its broken particles are shown.

1. Name the objects you see here. Also try to write the particles by which each of them are made of?

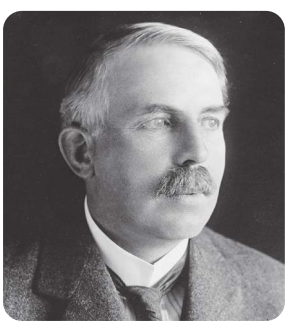
1. ----------
2. ----------
3. ----------
4. ----------

which he called electrons. According to this theory as the positive and negative charges are equal, the atom as a whole does not have any resultant charge.

Thomson's greatest contribution was to prove the existence of the negatively charged particles or electrons in an atom by experimentation. For this discovery, he was awarded the Nobel Prize in 1906. Although this theory explained why an atom is neutral, it was an incomplete theory in other ways.

4.1.3 Rutherford's theory

There were shortcoming in Thomson's theory. Earnest Rutherford gave a better understanding. Earnest Rutherford conducted an experiment. He bombarded a very thin layer of gold with positively charged alpha rays. He found that most of these rays which travel at a great velocity passed through thin gold sheet without encountering any obstacles. A few are, however, turned back from the sheet. Rutherford considered this remarkable and miraculous as if a bullet had turned back after colliding with tissue paper. Based on this experiment, Rutherford proposed his famous theory. They are:



Rutherford

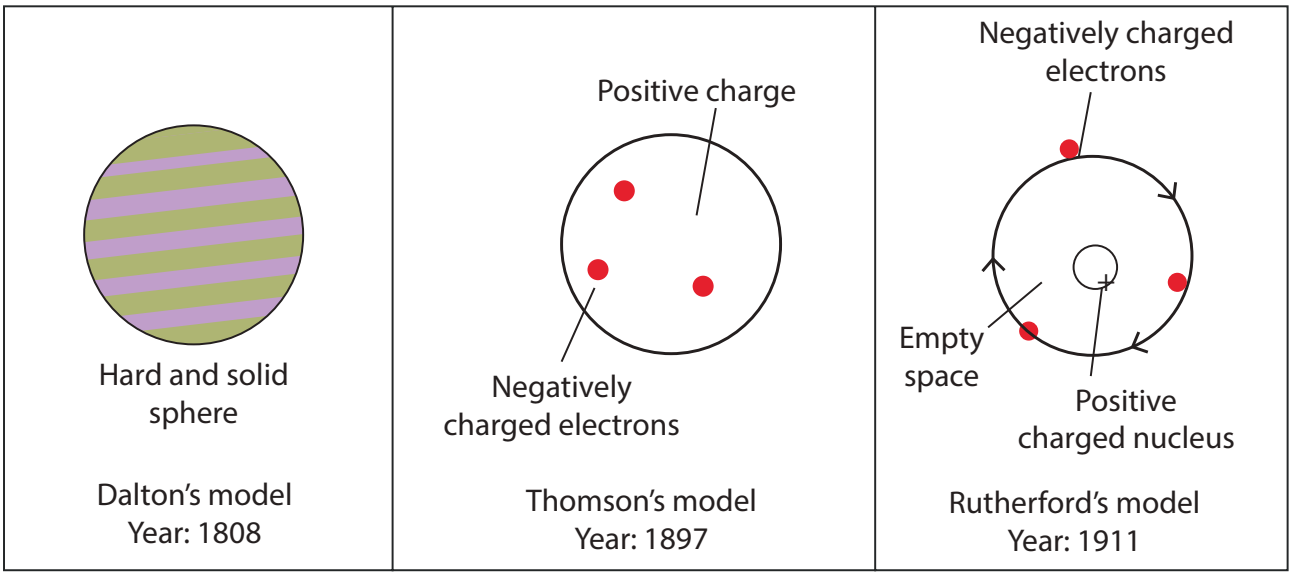
1. The fact that most alpha particles pass through the gold sheet means that the atom consists mainly of empty space.
2. The part from which the positively charged particles turned back is positively charged but it is very small in size as compared to the empty space.

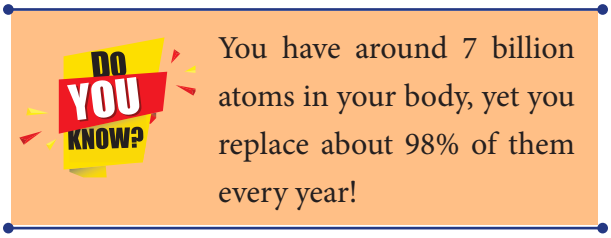
From these inferences, Rutherford presented his theory of the structure of atoms. For this theory, he was awarded the Nobel prize for chemistry.

Rutherford's theory proposes the following.

1. The nucleus at the centre of the atom has positive charge. Most of the mass of the atom is concentrated in the nucleus.
2. The negatively charged electrons revolve around the nucleus in specific orbits.
3. In comparison with the size of the atom, the nucleus is very very small.

Stages of discovery of the consitituents of an atom



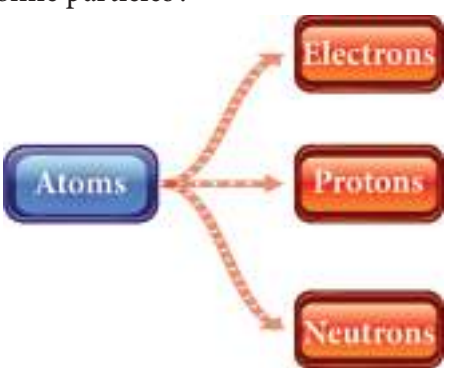


You have around 7 billion atoms in your body, yet you replace about 98% of them every year!

4.2 The sub-atomic particles

The discoveries made during the twentieth century proved that atoms of all elements are made up of smaller components - electron, proton and neutron. An electron from hydrogen atom is no different from the electron of a carbon atom. In the same manner, protons and neutrons of all elements also have same characteristics. These particles that make up the atom are called 'subatomic particles'.

CBPUQ



Proton (p)

The proton is the positively charged particle and it is located at the nucleus. Its positive charge is of the same magnitude as that of the electron's negative charge.

Neutron (n)

Neutron is inside the nucleus. The neutron does not have any charge. Except hydrogen (protium), the nucleus of all atoms contain neutrons. Protons and neutrons are the two types of particles in the nucleus of an atom. They are called nucleons.

Electron (e)

This is a negatively charged particle. Electrons revolve around the nucleus of the atom in specific orbits. The mass of an electron is negligible as compared to that of a proton or neutron. Hence, the mass of an atom depends on the number of protons and neutrons in the nucleus.

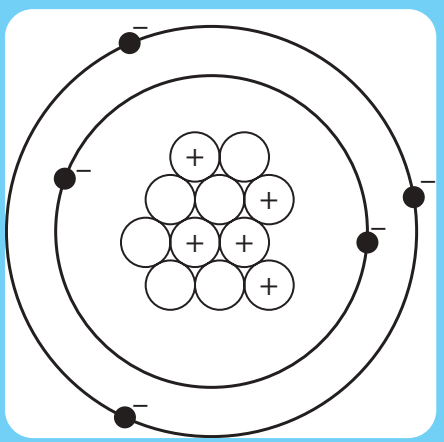
The total negative charge of all the electrons outside the nucleus is equal to the total positive charge in the nucleus. That makes the atom electrically neutral.

Table 4.1 Charge and mass of sub-atomic particles

Particle	Discoverer	Symbol	Charge	Mass (kg)
Proton	Goldstein	p	+1	1.6726×10^{-27}
Electron	Sir John Joseph Thomson	e	-1	9.1093×10^{-31}
Neutron	James Chadwick	n	0	1.6749×10^{-27}

ACTIVITY 2

Look at the given diagram and answer the following questions.



1. The positively charged particle is _____ .
2. The negatively charged particle is _____ .
3. _____ is the neutral particle.

4.3 Atomic number and Mass number

If all the elements are made up of same sub-atomic particles, how will a carbon atom differ from an iron atom? Further investigations led to the discovery that the number of protons inside the nucleus of an atom determines what element it is. For example, if the nucleus has only one proton, then all such atoms are hydrogen atoms. If there are eight protons then that atom is oxygen.

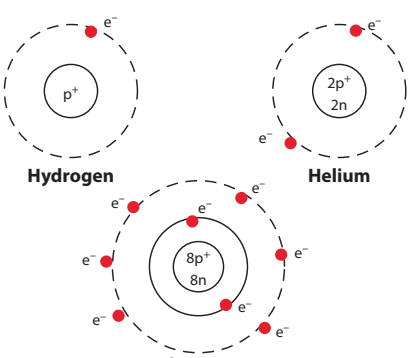
D8GZW

Is the structure of an atom same as the structure of the solar system? Yes ! It is similar to the solar system. It has a core (center) called nucleus and it has paths called orbits around the nucleus.

4.3.1 Atomic number (z)

The number of electrons or protons in an atom is called the atomic number of that atom. It is represented by the letter Z. If we know the atomic number of an atom, we can find the number of electrons or protons in it.

Look at the figures. The nucleus of hydrogen atom has one proton around which revolves one electron. It means that its atomic number (z) is 1.



In a helium atom, there are two protons in the nucleus and two electrons revolving in the orbit around the nucleus. So, the atomic number(z) of helium is 2.

Look at the atomic structure of oxygen shown in the figure. What is its atomic number?

Try yourself

If the atomic number of carbon is 6, what is the number of electrons revolving in its orbit?

4.3.2 Mass number (A) or Atomic mass

We have seen that the mass of an atom is concentrated in its nucleus. From this, we can get the mass number (A). It is equal to the sum of the number of protons (p) and number of neutrons (n) in the nucleus.

Atomic mass or Mass number

= Number of Protons + Number of Neutrons

$A = p + n$

Lithium atom contains 3 protons and 4 neutrons. Its mass number (A) = 3+4 = 7. In a sodium atom, there are 11 Protons and 12 neutrons. Hence, its mass number (A) is 23 (11 + 12).

Try yourself

1. Why the atomic numbers and mass numbers are always whole numbers?
2. A sulphur atom contains 16 protons and 16 neutrons. Calculate its atomic number and mass number.

While writing the symbol of an element, its atomic number and mass number are also written. For example, the symbols of hydrogen, carbon and oxygen are written as $_1H^1$, $_6C^{12}$, $_8O^{16}$ respectively. All the elements in the periodic table have the following combination of protons, electrons and neutrons.

Table 4.2 Symbols of elements

Element	Symbol	Number of proton, electron, neutron,
Carbon	$_6C^{12}$	**6p,6e,6n**
Beryllium	$_4Be^9$	4p,4e,5n
Nitrogen	$_7N^{14}$	7p,7e,7n
Boron	$_5B^{11}$	5p,5e,6n

Isotopes

Atoms of element can have different number of neutrons. Such atoms will have same atomic number but different mass numbers. These atoms are called isotopes. For example, hydrogen has three isotopes. They are: Proteum ($_1H^1$), Deuterium ($_1H^2$), Tritium ($_1H^3$).

Isobars

Atoms that have the same mass number but different atomic numbers are called isobars. Example: Calcium ($_{20}Ca^{40}$), Argon ($_{18}Ar^{40}$).

Table 4.3 Elements and their symbols with their atomic number and mass number

Element	Symbol	Atomic number	Protons (p)	Neutrons(n)	Mass number(p+n)
Hydrogen	H	1	1	0	1
Helium	He	2	2	2	4
Aluminium	Al	13	13	14	27
Oxygen	O	8	8	8	16
Sodium	Na	11	11	12	23

ACTIVITY 3

H Hydrogen Atomic Number: 1 Atomic Mass: 1 Protons: 1 Neutrons: 0 Electrons: 1	**He** Helium Atomic Number: 2 Atomic Mass: 4 Protons: 2 Neutrons: 2 Electrons: 2	**Li** Lithium Atomic Number: 3 Atomic Mass: 7 Protons: 3 Neutrons: 4 Electrons: 3	**Be** Beryllium Atomic Number: 4 Atomic Mass: 9 Protons: 4 Neutrons: 5 Electrons: 4	**B** Boron Atomic Number: 5 Atomic Mass: 11 Protons: 5 Neutrons: 6 Electrons: 5
C Carbon Atomic Number: 6 Atomic Mass: 12 Protons: 6 Neutrons: 6 Electrons: 6	**N** Nitrogen Atomic Number: 7 Atomic Mass: 14 Protons: 7 Neutrons: 7 Electrons: 7	**O** Oxygen Atomic Number: 8 Atomic Mass: 16 Protons: 8 Neutrons: 8 Electrons: 8	**F** Fluorine Atomic Number: 9 Atomic Mass: 19 Protons: 9 Neutrons: 10 Electrons: 9	**Ne** Neon Atomic Number: 10 Atomic Mass: 20 Protons: 10 Neutrons: 10 Electrons: 10
Na Sodium Atomic Number: 11 Atomic Mass: 23 Protons: 11 Neutrons: 12 Electrons: 11	**Mg** Magnesium Atomic Number: 12 Atomic Mass: 24 Protons: 12 Neutrons: 12 Electrons: 12	**Al** Aluminium Atomic Number: 13 Atomic Mass: 27 Protons: 13 Neutrons: 14 Electrons: 13	**Si** Silicon Atomic Number: 14 Atomic Mass: 28 Protons: 14 Neutrons: 14 Electrons: 14	**P** Phosphorus Atomic Number: 15 Atomic Mass: 31 Protons: 15 Neutrons: 16 Electrons: 15
S Sulfur Atomic Number: 16 Atomic Mass: 32 Protons: 16 Neutrons: 16 Electrons: 16	**Cl** Chlorine Atomic Number: 17 Atomic Mass: 35 Protons: 17 Neutrons: 18 Electrons: 17	**Ar** Argon Atomic Number: 18 Atomic Mass: 39 Protons: 19 Neutrons: 20 Electrons: 19	**K** Potassium Atomic Number: 19 Atomic Mass: 39 Protons: 19 Neutrons: 20 Electrons: 19	**Ca** Calcium Atomic Mass: 20 Atomic Number: 40 Protons: 20 Neutrons: 20 Electrons: 20

Observe the table given above and answer the following questions.

1. I am used for breathing, without me you cannot live. Write my name and symbol.

   _____.

2. It is used in filling the balloons. It is a gas, identify it. What is its mass number?

   _____.

3. Name the element present in banana. What is its atomic number?

   _____.

4. I am found in crackers. How many protons do I have?

   _____.

5. I am the most valuable element. Find who am I. Can you say my mass number?

   _____.

4.4 Valency

When we shake hands with others, we can either shake hand with one persons using one hand or shake hand with two persons using both our hands. If we have more hands, we can shake hands with more persons. In the same manner atoms can share either one electron or two or three or four electrons and some cannot share any electron. This property is called valency.

Table 4.4 **Elements and their symbols with their atomic number and mass number and valency.**

Element	Symbol	Atomic Number	Mass Number	Valency
Hydrogen	H	1	1	1
Carbon	C	6	12	4
Oxygen	O	8	16	2
Sodium	Na	11	23	1
Calcium	Ca	20	40	2

What makes atoms stick together?

Electrons carry a negative electric charge, and protons carry a positive charge. The attraction between them holds electrons in orbits.

Valency is the combining property of an atom. It is a measure of how many hydrogen atoms it can combine with. For example, oxygen can combine with two hydrogen atoms and create water molecule. So, the valency of oxygen atom is two. In the case of chlorine, it can combine with only one hydrogen to create HCl (hydrochloric acid). Here, the valency of chlorine is one. Methane (CH_4) has one carbon atom combining with four hydrogen atoms. Can you guess the valency of carbon in methane? In ammonia molecule, nitrogen combines with three hydrogen atoms. What is the valency of nitrogen in ammonia?

Atoms of different elements combine with each other to form molecules. Valency determines the number of atoms of an element that combines with atom or atoms of another type.

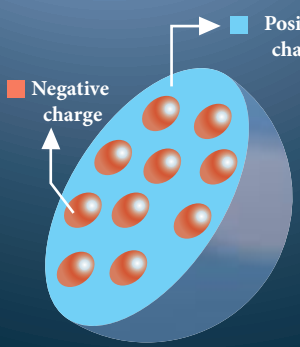
The element having valency one is called monovalent. Example: Hydrogen and Sodium. The elements having valency two are called divalent. Example: Oxygen and Beryllium. The elements having valency three are called trivalent. Example: Nitrogen and Aluminium. Some elements exhibit more than one valency. For example, iron combines with oxygen to form two types of oxides namely, ferrous oxide (exhibits valency 2) and ferric oxide (exhibits valency 3). We will study about them in detail later.

When atoms of different elements combine with each other, molecules of compounds are formed. In these instances, it is necessary to know the valancies of those elements. Valencies of some elements are given in Table 4.4.

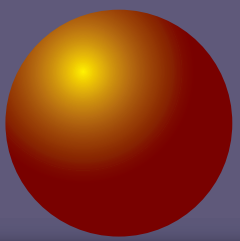
Points to Remember

- An atom is the smallest particle of an element that retains its chemical properties. They are very tiny compared to other particles.
- Atoms are too small to be seen by the naked eye or even through microscope.
- An atom consists mostly of empty space.
- Atoms of same element are identical, and atoms of different elements differ.
- An atom consists of a dense nucleus which has positively-charged protons and electrically-neutral neutrons.
- The protons and neutrons are called nucleons.
- An atom is electrically neutral. They contain equal number of protons and electrons.
- Atomic number is the number of protons in an atom.
- The total number of protons and neutrons present in the nucleus of an atom is called its mass number.
- Valency is defined as the combining capacity of an element.

Evolution of the atomic structure



J.J. Thomson proposes the "plum pudding" model of the atom, picturing negatively charged electrons rotating in concentric rings within a sphere of positive electricity

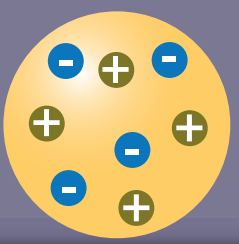


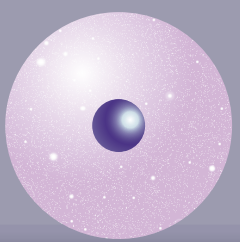
1803

DALTON THEORY

1904

J.J. THOMSON THEORY



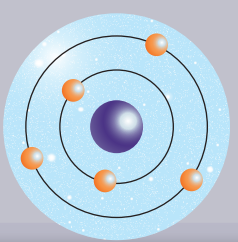


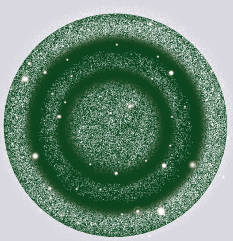
1911

RUTHERFORD THEORY
(the nucleus)

1913

BOHR THEORY
(the energy levels)

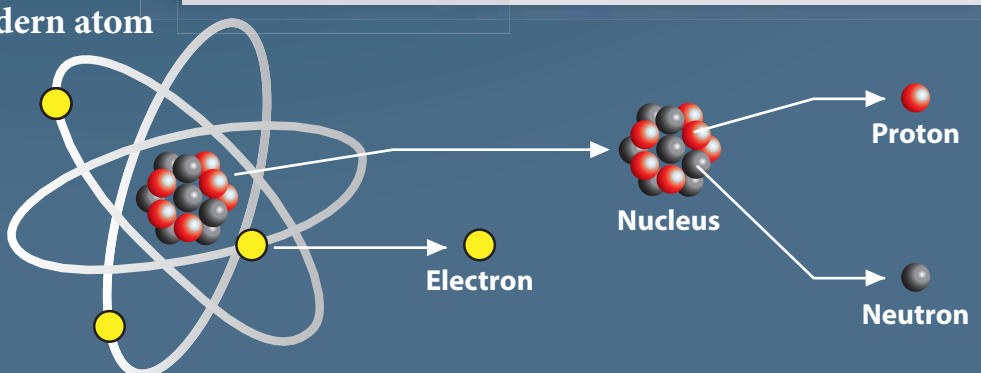




1926

SCHRODINGER THEORY
(electron cloud model)

Modern atom



Evaluation

I. Choose the appropriate answer.

1. The basic unit of matter is _____
   a. element b. atom
   c. molecule d. electron
2. The sub-atomic particle which revolves around the nucleus is _____
   a. atom b. neutron
   c. electron d. proton
3. _____ is positively charged.
   a. Proton b. Electron
   c. Molecule d. Neutron
4. The atomic number of an atom is the _____
   a. number of neutrons
   b. number of protons
   c. total number of protons and neutrons
   d. number of atoms
5. Nucleons comprises of _____
   a. protons and electrons
   b. neutrons and electrons
   c. protons and neutrons
   d. neutrons and positron

II. Fill in the blanks.

1. The smaller particles found in the atom are called _____.
2. The nucleus has _____ and _____ .
3. The _____ revolve around the nucleus.
4. If the valency of carbon is 4 and that of hydrogen is 1, then the molecular formula of methane is_____ .
5. There are two electrons in the outermost orbit of the magnesium atom. Hence, the valency of magnesium is_____ .

III. Match the following.

Valency	Fe
Neutral particle	Proton
Iron	Electrons in the outermost orbit
Hydrogen	Neutron
Positively charged particle	Monovalent

IV. State true or false. If false, correct the statement.

1. The basic unit of an element is molecule.
2. The electrons are positively charged.
3. An atom is electrically neutral.
4. The nucleus is surrounded by protons.

V. Complete the analogy.

1. Sun : Nucleus :: Planets : _____.
2. Atomic number : _____ :: Mass number : Number of protons and neutrons.
3. K: Potassium :: C : _____.

VI. Consider the following statements and choose the correct option.

1. **Assertion**: An atom is electrically neutral.
   Reason: Atoms have equal number of protons and electrons.
2. **Assertion:** The mass of an atom is the mass of its nucleus.
   Reason: The nucleus is at the centre.

3. **Assertion:** The number of protons or the number of neutrons is known as atomic number.
   Reason: The mass number is the sum of protons and neutrons.

VII. Answer very briefly.

1. Define – Atom.
2. Name the sub-atomic particles.
3. What is atomic number?
4. What are the characteristics of proton?
5. Why neutrons are called neutral particles?

VIII. Answer briefly.

1. Distinguish isotopes from isobar.
2. What are isotones? Give one example.
3. Differentiate mass number from atomic number.
4. The atomic number of an element is 9. It has 10 neutrons. Find the element from the periodic table. What will be its mass number?

IX. Answer in detail.

1. Draw the structure of an atom and explain the position of the sub-atomic particles.
2. The atomic number and the mass number of an element is 26 and 56 respectively. Calculate the number of electrons, protons and neutrons in its atom. Draw the structure.
3. What are nucleons? Why are they called so? Write the properties of the nucleons.
4. Define valency. What is the valency of the element with atomic number 8? What is the compound format by this element with hydrogen?

X. Higher Order Thinking Skills.

1. An atom of an element has no electron. Will that atom have any mass or not? Can an atom exist without electron? If so then give example.
2. What is common salt? Name the elements present in it. Write the formula of common salt. What are the atomic number and the mass number of the elements? Write the ions in the compound.

XI. Project.

To have an idea of what atoms are, students can be asked to construct atoms using pipe cleaners (thin metal wires-electron shells), pom-poms (balls-different colours for protons and neutrons) and beads (electrons). Students will love and enjoy putting them together and they look great hanging from the ceiling in the classroom.

ICT CORNER

Atomic Structure

Let's build an atom.

PROCEDURE :

Step 1: Use the URL to reach stimulation page. Click play button to launch the simulation.

Step 2: Click on the"ATOM" , a new window will be open. Drag the particles (Protons, Neutrons and Electrons) from the baskets which is at the bottom of the display.

Step 3: You can observe the changes in 'Elements, Net charge and Mass number' at the right side windows.

Step 4: Click on the 'Symbol" at the bottom. Drag the particles and get the Symbol of the element.

Step 5: Click on the"GAME" and play the games.

Step 1

Step 2

Step 3

Step 4

Atomic Structure URL:

https://phet.colorado.edu/en/simulation/build-an-atom

*Pictures are indicative only

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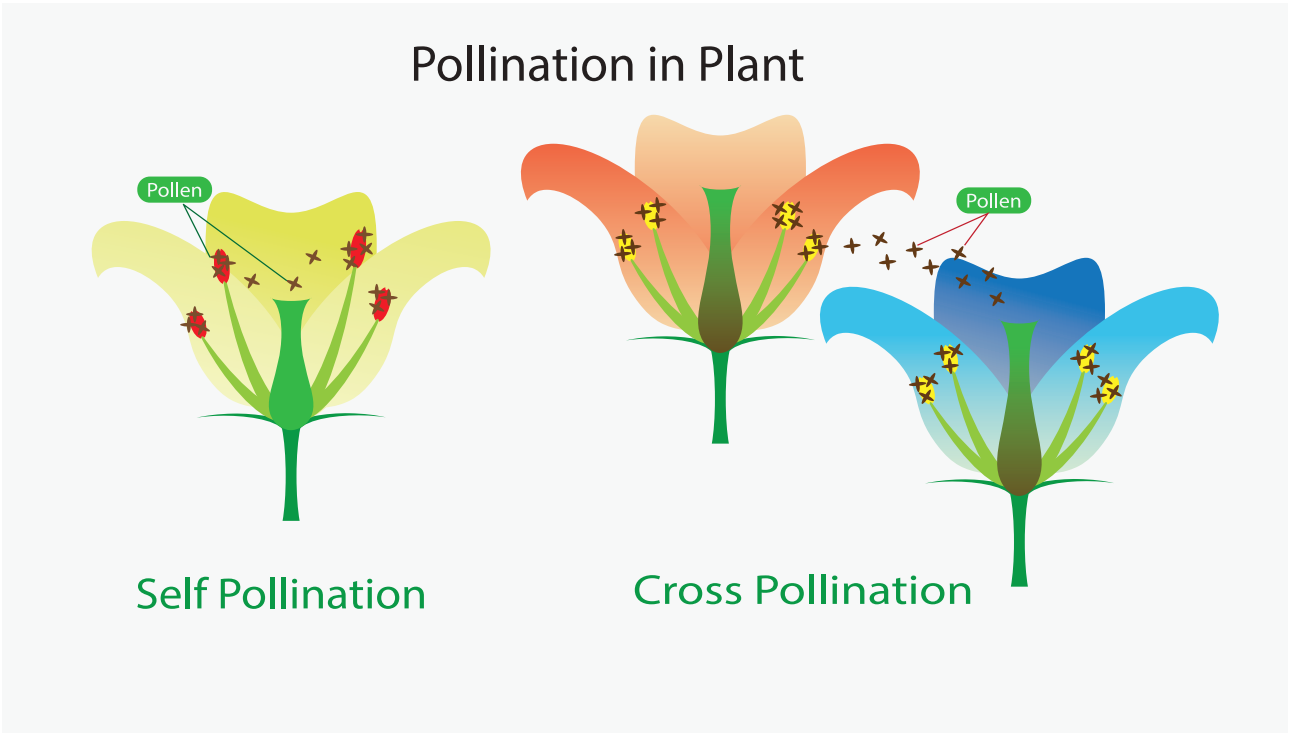
Unit 5

Reproduction and Modification in Plants



Learning Objectives

After studying this lesson, students will be able to:

- understand how a flower becomes a fruit with seed through pollination and fertilization.
- acquire knowledge about pollination and pollinators.
- differentiate self pollination and cross pollination in plants.
- know about the modification of root, stem and leaves.
- understand how these modifications are useful to animal and human being.

Introduction

We know already that flowering plants have root, stem and leaves. They are called vegetative organs. Flowers, fruits and seeds in a plant are called reproductive organs. In earlier classes we have seen that new plants can be grown from seeds. In this lesson, we are going to know how a flower changes itself into a fruit, and the modifications of root, stem and leaves of a plant.

5.1 Reproduction

ACTIVITY 1

Aim

To raise a new generation of plant from watermelon and potato.

Materials required

Two pots with soil, potato, watermelon seeds and water.

Procedure

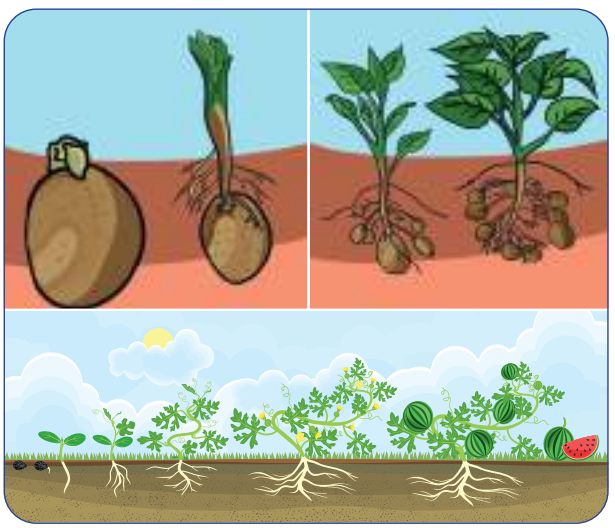
Fill both pots with soil mixed with compost or manure. Take a young potato. Ensure that it is not dried up and the skin still looks fresh. Bury a potato in one pot. Sow watermelon seeds in another pot. Pour water regularly and maintain the plant.

Observation

After few days, we can see a single plant arising from a buried potato. Plants arise from the pot sowed with watermelon seeds. Each seed produces a plant.

We can see from this activity that watermelon plant is produced from that seeds. Potato plant is not from seed, but from the stem tuber (vegetative part). Seed is not only the source for new generation, even vegetative part of a plant can be used to produce a new plant.

The process by which plants and animals produce young ones and increase their number is known as 'reproduction'. Drumstick tree can be grown from both seeds and stem cuttings. When plants are reproduced from the seeds we call that process as **sexual reproduction.** All other ways of reproduction without seed are called as **asexual reproduction.**



Reproduction in plants

ACTIVITY 2

Find out how these plants reproduce.

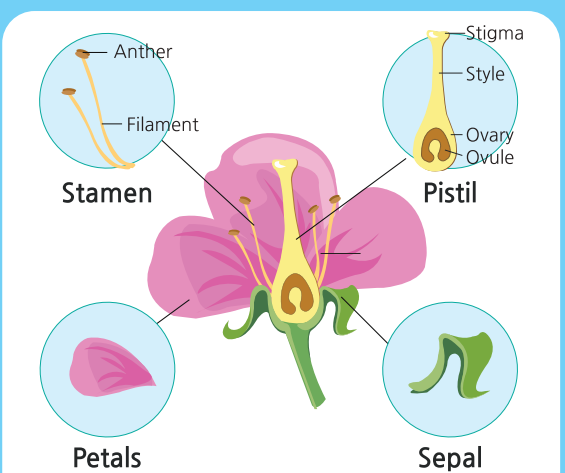
Sl. No.	Name of the plant	Reproductive Part			
		Seed	Stem	Cutting	Layering
1.	Mango				
2.	Potato				
3.	Banana				
4.	Tamarind				
5.	Rose				
6.	Mustard				
7.	Coriander				
8.	Moringa				
9.	Pumpkin				
10.	Radish				

5.2 Sexual reproduction

Seed is produced from a flower by the process of pollination and fertilization. This is known as sexual reproduction. To understand how seeds are formed in a flower, first we need to understand parts of a flower.

ACTIVITY 3

Take a flower. Dissect it longitudinally as shown in the figure and find the parts inside the flower. Can you identify the male reproductive part, androecium (stamen, filament and pollen sac)? Carefully observe the female reproductive part, gynoecium (ovary, style and stigma). If they are not seen clearly, gently pluck off the sepals and petals. Make a drawing of the parts and arrange them in your notebook.



L.S. of a flower showing its parts

5.2.1 Parts of flower

Let us compare few buds and opened flowers of **Hibiscus and Datura.** Observe bud and opened flower of **Hibiscus** and **Datura.** We can tabulate the characteristics of Hibiscus and Datura flowers as below.

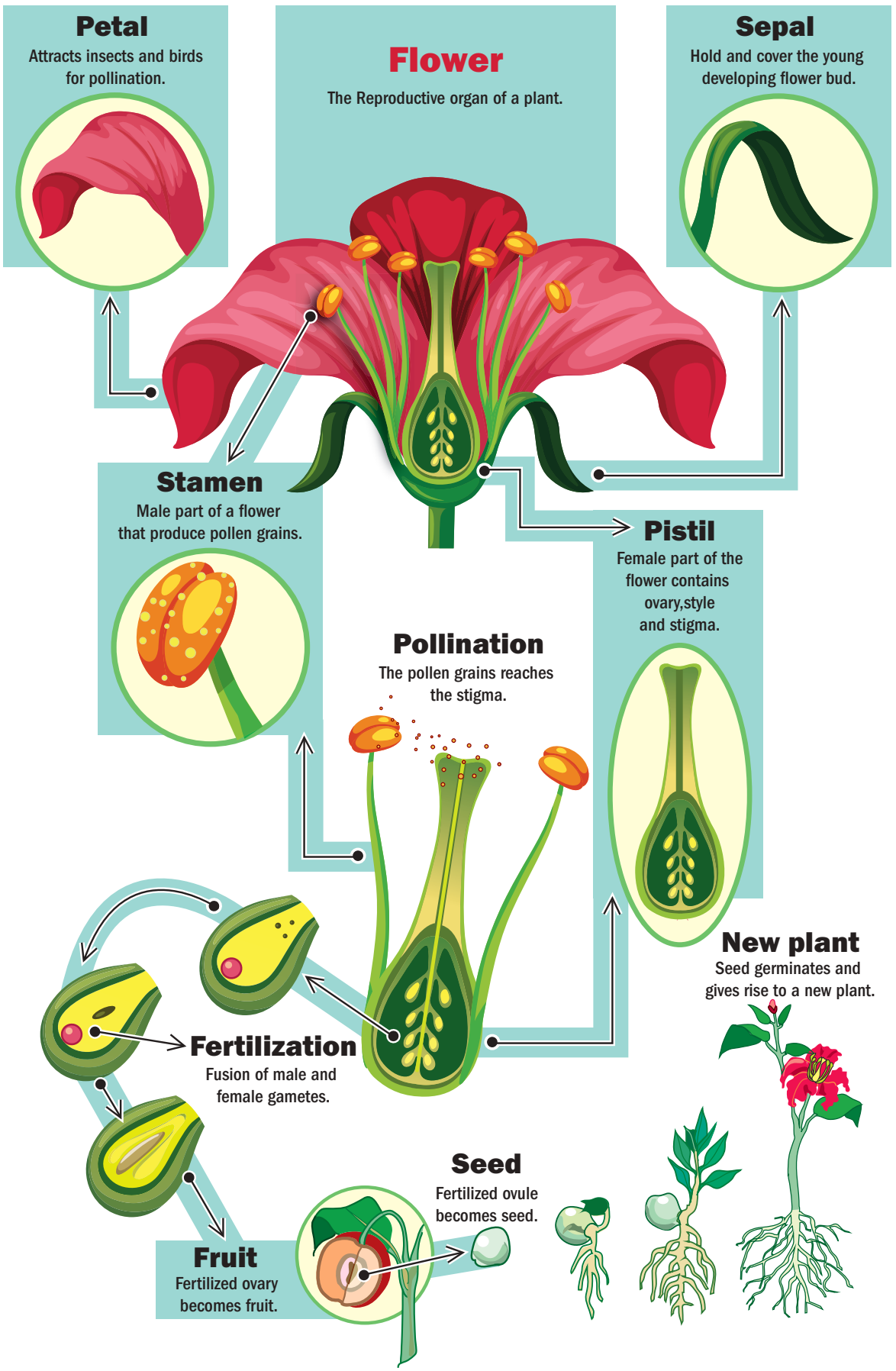
Hibiscus flower	
Bud	**Opened flower**
Green colour	Bright colour
Sepals	Petals
Dissected Hibiscus flower	
Bud	**Opened flower**
Curled petals	Expanded petals
Small tube with yellow lobes - Anthers	Expanded tube with yellow lobes -Anthers

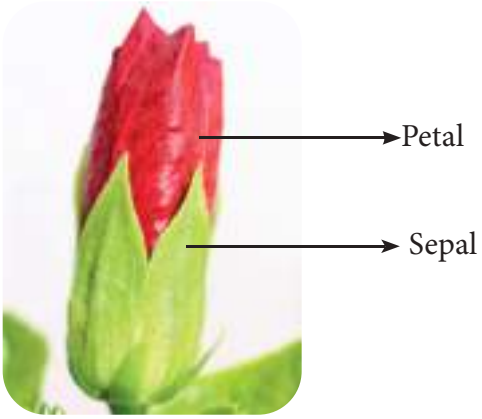
Datura flower	
Bud	**Opened flower**
Green colour	White colour
Sepals	Petals
Dissected Datura flower	
Bud	**Opened flower**
Curled petals	Expanded petals
Small yellow lobes-Anthers	Expanded yellow lobes-Anthers

In a bud, we can see a green colour, leaf like structure which cover the whole bud or flower. Each of these green leaf like structure present as an outermost layer is called as **sepal**. This outer most ring of sepals is known as **calyx.**

Petals are the largest part of flowers. They are often attractive, brightly coloured, sometimes sweet scented and attract the insects. This ring of **petals** together is called **corolla**.

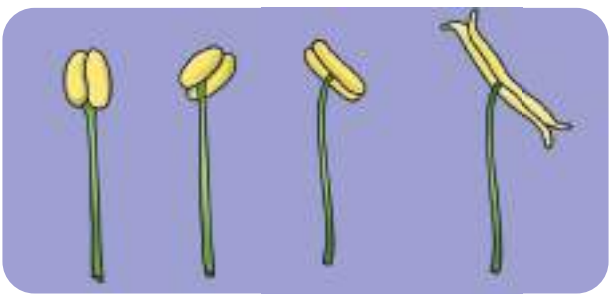
SEXUAL REPRODUCTION IN PLANTS





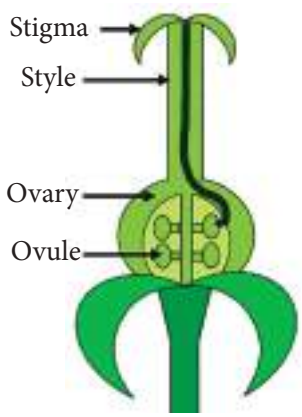
Sepal and Petal

Inside corolla, in **Hibiscus,** we can observe a long tube on which many stamens are arranged. But, in **Datura** we can see only five stalked structures, stamens. This ring or whorl of a flower is called **androecium.** Each stamens consists of two parts – a stalk called filament and a lobe called anther. If you touch these lobes in a mature flower, we can get a powdery substance called pollen grains (male reproductive part).



Androecium - Male part of the flower

Inside androecium whorl, we can find a female reproductive part of the flower, called gynoecium. You will find this part with a swollen bottom part.



Gynoecium – Female reproductive part

This is the ovary. Seeds are produced in this part. On top of the ovary there is a slender tube like structure called style. The top most sticky tip of the style is stigma. Pollen grains are received by the stigma. This is the fourth whorl of a flower.

5.2.2 Types of flowers

Flowers can be divided into two types. They are explained below.

Complete Flower

If all the four whorls - calyx, corolla, stamens and pistil are present, then it is called as complete flower. Complete flowers are bisexual flowers.

Incomplete Flower

If any of these four whorls is missing, then it is called as incomplete flower. Incomplete flowers are unisexual flowers. There are two types of unisexual flowers, **male flower** and **female flower**.

The flower with androecium and without gynoecium is called as **male flower** and the one with gynoecium and without androecium is known as **female flowers**.

Sunflower is not a single flower. It is a group of flowers clustered together. A group of flowers arranged together is called inflorescence. *Tridax procumbens*, looks like a single flower, but it is an inflorescence. Leaf juice of this plant is used to cure wounds and cuts.

ACTIVITY 4

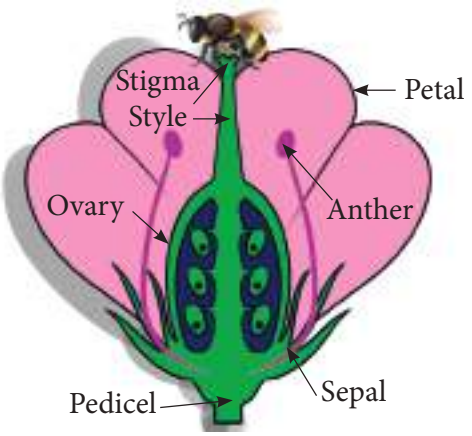
Make a flower album

Collect some flowers and press them between pages of newspaper or book. Place two thick sheets and keep a heavy object, such as brick, on the top to apply pressure. Turn the sides every two to three days. Allow flowers to dry completely. Collect the dried flowers and paste them in an album. Now, your flower album is ready.

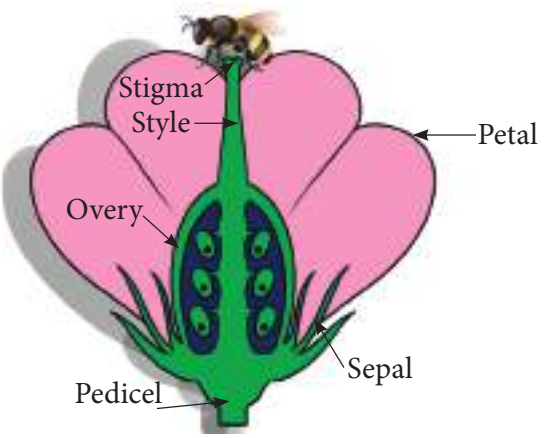
ACTIVITY 5

Using the information from the above diagram complete the following table:

Name of the flower	Complete / Incomplete	Unisexual / Bisexual	Male / Female
Hibiscus			
Pumpkin			
Rose			
Coconut			
Jasmine			



Bisexual Flower



Unisexual Flower

5.2.3 Pollination

We know that flowers of pumpkin are unisexual - that is some flowers are male while many are female flowers. We can easily identify the male and female flower of pumpkin, even before the buds bloom. To understand how a flower develops into fruit, let us perform an experiment on pumpkin plant.

ACTIVITY 6

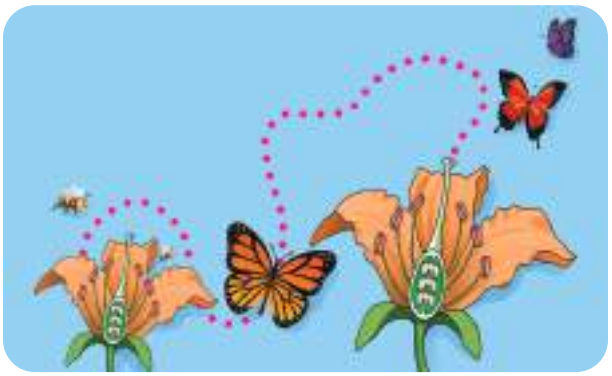
Once flower buds appear, immediately identify ten female flower buds from a pumpkin plant. Tie a plastic bag around each bud so that no outside material can enter inside. Ensure to make small holes with a pin to allow air flow. Wait for two to three days to bloom.

Female

Male

Choose three to four male flowers. Pluck the stamens of these flowers and dust the pollen grains in a sheet of paper and collect it. Open five out of ten bags containing female flowers. Brush the collected pollen grains on the stigma with a soft paint brush. Take care not to damage the stigma. After few days we can see that flower in all bags that were not opened at all would wilt without forming a fruit, while most of the flowers to which pollens have been applied bear fruits.

In the above experiment we transferred the pollen grains from male flower to the female flower. This is called as an **artificial pollination**. However, in nature there are many ways in which pollen grains reach the stigma of the flower and it is called as **natural pollination.**

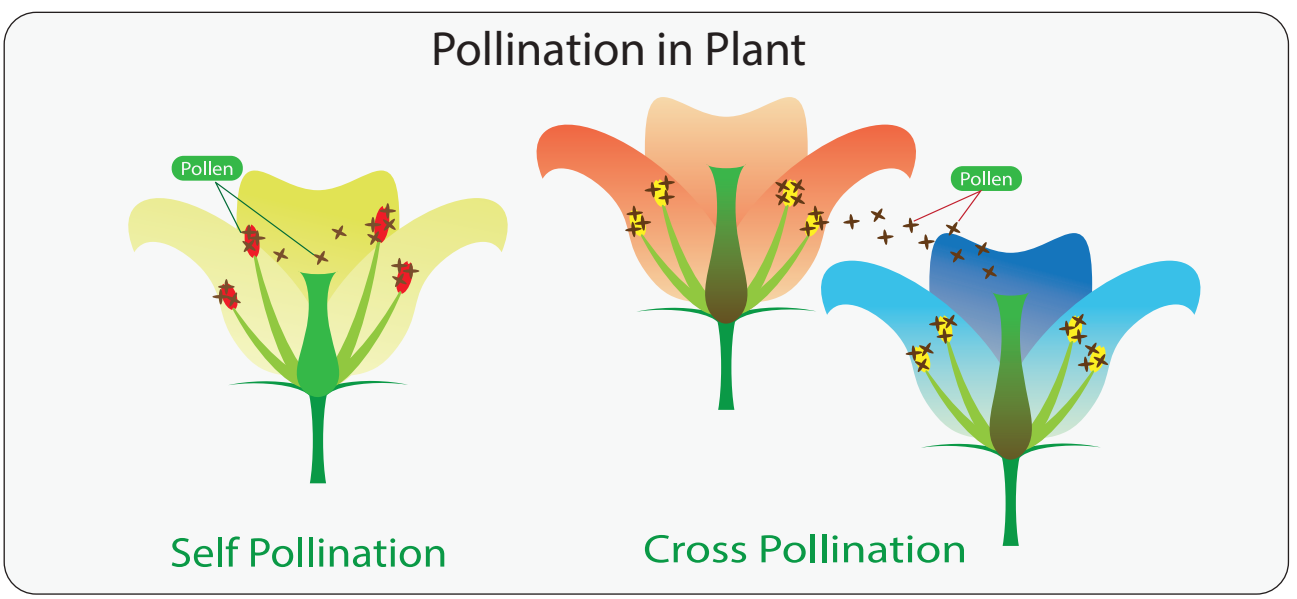


In some plants like grasses, pollen grains are light. Stamens shed pollen grains, and are carried by wind to other flower. Insects, birds are also agents of pollination. Bees, butterflies and variety of birds hover around flowers. They help to carry pollen from one flower to another. Pollen grains stick to their legs, wings or abdomen when they move from one flower to another. This is called as **cross pollination**

When you shake stamens, pollen grains fall. Thus, when wind shakes the flower or when a butterfly agitates the flower, pollen grains could fall onto the stigma of the same flower. Some plants that have both the male and female parts within a single flower (bisexual) pollinate by this means. This is called as **self pollination**.

Table 5.1 Differences between self pollination and cross pollination.

Self Pollination	Cross Pollination
Pollen grains are transferred from the anther to the stigma of the same flower.	Pollen grains are transferred from the anther of one flower to the stigma of another flower of the same plant or same variety.
Plants do not need to produce pollen grains in a large quantity for self pollination	Plants need to produce pollen grains in larger quantities to increase the chance of pollination.
It does not produce changes in the characteristics of new plants.	Cross pollination does introduce variations in the characteristics of new plants.



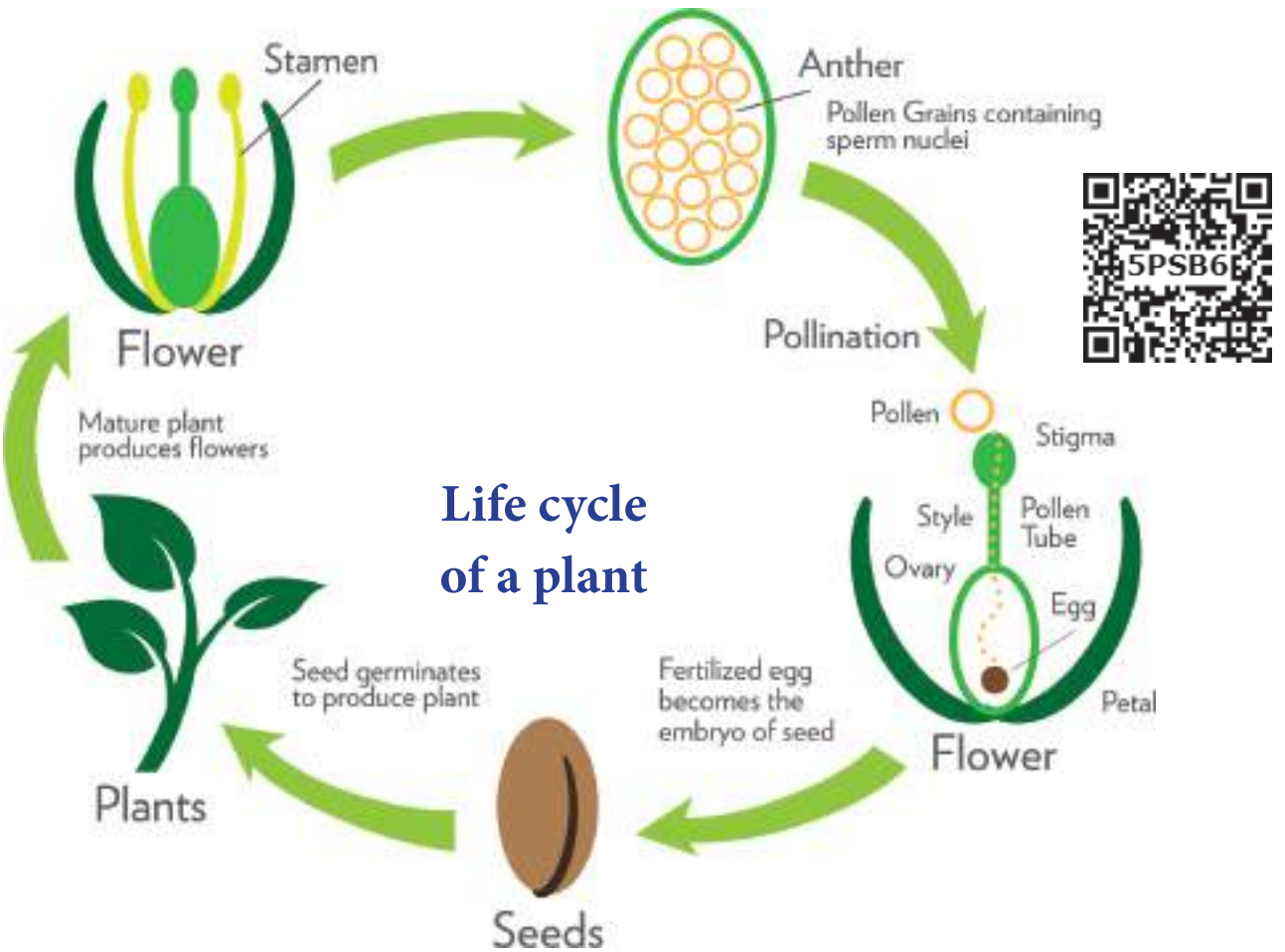
Beans (Fabaceae) and tomatoes (Solanaceae) commonly self-pollinate. Even though, for example, tomato self pollinate, they need the help of the insects to create vibrations within the flowers that will effectively loosen the pollen. Paddy is mostly self pollinating using just gentle wind as the pollinating agent. The agents that are helping in pollination are called **pollinators.**

In many plants, pollens have to come from some other flowers. This is obvious in case of plants which have distinct male and female flowers like pumpkin. In some flowers the gynoecium matures first before the androecium shed pollens. Such plants need cross pollination. Plants such as apples, plums, strawberries, pumpkins use insects for cross-pollination.

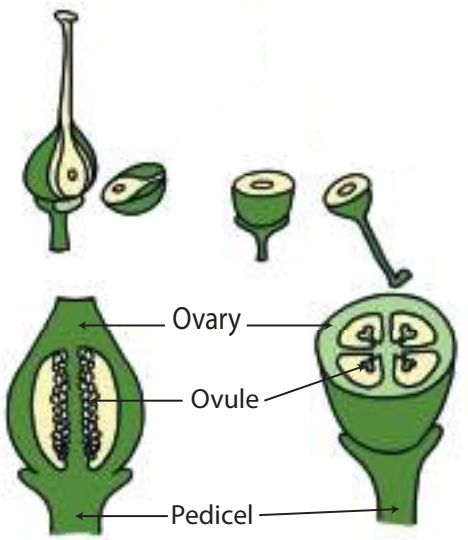
5.2.4 Fertilization

During pollination, pollen grains reach stigma. What happens to them after this? Substances produced on the stigma causes the pollen grain to germinate. During the germination a tube develops from the pollen grain which carries male gametes and ultimately reaches female gamete inside the ovary through the style. Male gamete fuses with the female gamete to form zygote. This process is known as **fertilization.**

Where is this female gamete located? Inside the ovary, small rounded structures, ovules are present. In these ovules, female gamete is present. To know more about this, we should cut ovary of a flower in longitudinal and transverse ways.



Cut a ovary of a flower both vertically and horizontally. Observe the ovules. Compare the ovary and ovules from few different flowers. Are there one or more ovules? Can you see any connection between the number of ovules in the ovary and number of seeds in each fruit?



Longitudinal Section of an Ovary **Transverse Section of an Ovary**

Collect some fruits like tomato, brinjal, lady's finger (vegetable), mango, peas and custard apple and observe. You can see some green part above brinjal and lady's finger. What are they?

Compare mango, custard apple and peas. All these are single fruits but custard apple has many small parts in it, each with a seed. Mango has a single seed and pea has many seeds. What do you understand from the above observations?

- A green part above fruits of **brinjal** and **lady's finger** are sepals of a flower. In some plants, after fertilization, sepal will not fall from fruit and remain or persist with fruit.
- **Custard apple** is made up of many fruits, aggregated together. Each fruit part is thin, membranous with some granule like, which is edible.
- In **mango** the outer skin and middle pulpy are edible and sweet. The inner most part is with single seed.
- In **pea** the fruit is not fleshy, but forms a covering pouch for many seeds.

In all the above fruits, ovary, a lower most swollen part of pistil develops into a fleshy fruit. Ovules present inside the ovary gets transformed into a seed.

Hence, now with these observations, we shall list the changes taking place in a flower after fertilization. These are collectively said to be **post fertilization changes**

- ❖ Calyx sometimes persist with fruit.
- ❖ Petals fall off.
- ❖ Androecium fall off.
- ❖ Pistil remain and develops into a fruit.
- ❖ Style and stigma fall off
- ❖ Ovary enlarges to store food materials and develops into a fruit.
- ❖ Ovules present inside the ovary develops into seeds.

The world's largest and heaviest seed is the double coconut. The seed looks like two coconut fused together. It grows only in two islands of the Seychelles. A single seed may be 12 inches long, nearly 3 feet in circumference and weighs about 18 kg.

Orchids have the smallest seeds in the plant kingdom. 35 million seeds may weight only about 25 gram.

5.3 Asexual reproduction

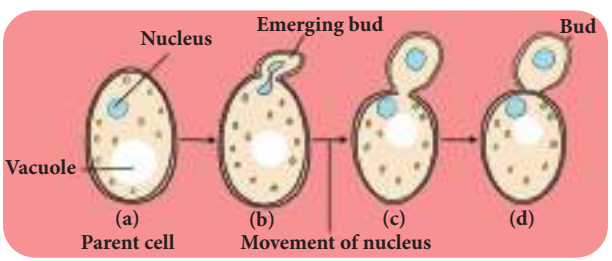
We saw that plants reproduce not only from seeds but by other processes as well. The production of new plants without the involvement of pollination and fertilization is known as asexual reproduction. Let us study the types of asexual reproduction.

5.3.1 Vegetative Propagation

In potato, shoot arise from eyes. Sugar cane and yam also grow like this. Vegetative parts of the plants such as root, stem and leaves can help to produce the plant.

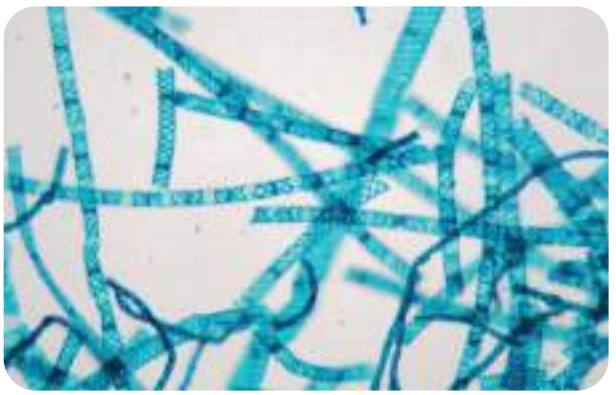
5.3.2 Budding

When we go to a bakery we see so many types of cakes and breads. These are very soft in nature. This is due to the presence of yeast. Single yeast undergoes asymmetric division. It produces a small protuberance which gradually grow and detach from the parent cell. This process is called **budding**.



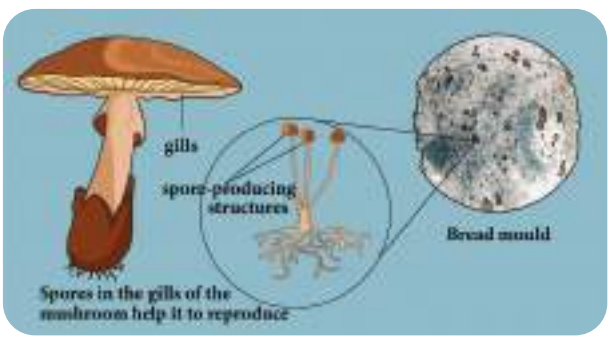
5.3.3 Fragmentation

In a pond we see so many algae. **Spirogyra** is a filamentous alga. When it matures, the filament divides into pieces. Each fragment or piece of a filament will grow into a new filament or individual. Likewise **spirogyra** produces so many young ones and this process is known as **fragmentation.**



5.3.4 Spore Formation

Scarcity of water, high temperature, nutrient deficiency in soil etc., are unfavourable conditions. During these conditions non-flowering plants like algae, fungi, moss and ferns produce spores. They germinate into a new plant when favourable conditions return.



5.4 Modifications of plant parts

Compare the given plants and discuss with your teacher.

Carrot Plant

Grass

Onion

Potato

Carefully remove a fresh carrot plant from the soil and observe it. Look at the part we usually consume as 'carrot vegetable'. It is not a unripe fruit, but the tap root of the carrot plant. We can see that the tap root of the carrot is swollen. In the case of the carrot plant, the tap root has a different characteristics than the usual plants. Normally, each plant organ originally evolves to meet certain needs of the plant. For example, roots evolve primarily to anchor the plant and also to absorb water and mineral nutrients from the soil.

Leaves are adapted to optimize photosynthesis. Stems evolve to reach out to sunlight and also to conduct water from roots to leaves. However in certain plant species, specific parts have evolved further in unusual and surprising ways to meet certain other specific needs, In some plants, root, stem, and leaves change their shape and structure to perform special functions like storage of food, mechanical support, protection and other vital functions. This is known as modification.

What appear as the 'leaf' of a cacti are actually their stem and what appear as 'spine' on them are actually leaf. Its leaves are modified into spines, an adaptation to reduce transpiration. Photosynthesis is performed by the stem part of the plant. In this section let us study about the modification of root, stem and leaves.

5.4.1 Modification of Root

a. Roots for storage

Look at radish, turnip, beet root, and carrot. They all grow under the soil. As soon as you pluck it from the ground if you wash them gently, you will notice small roots dangling from their surface. All these vegetables are in fact roots of the plant. Instead of thin slender roots, they have become a place to store the food produced by them. Hence, they are thick and swollen. One can notice that the tap root of radish is in the shape of spindle, swollen in the middle and tapering at both ends. Such type of modified roots are called spindle shaped root.

Radish

At times, like in the case of turnip and beet root, the tap root can acquire a shape of top, that is spherical at the base and tapering shortly towards the apex. They are called as top shaped root.

Beet Root

In case of **carrot,** the shape is conical, broad at the apex and tapering gradually towards the base and such modified roots are called conical shaped root.

Carrot

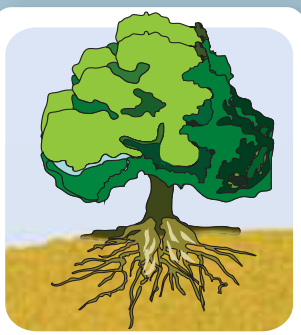
PLANT MODIFICATION

Modification of Root

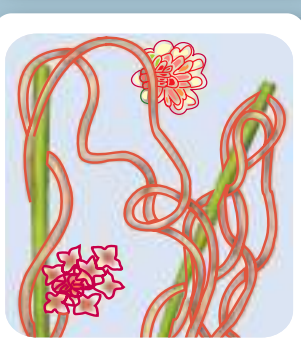
To perform special functions the roots change their size and shape.

STORAGE OF FOOD
e.g. Beet root

MECHANICAL SUPPORT
e.g. Banyan tree



GASES EXCHANGE
e.g. Avicennia

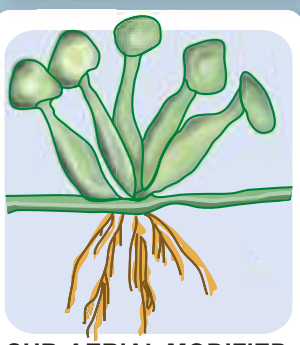


SUCKING ROOT
e.g.Cuscuta

Modification of stem

Stem modified for storing the food materials and for vegetative propagation.

AERIAL MODIFIED
e.g. Cactus

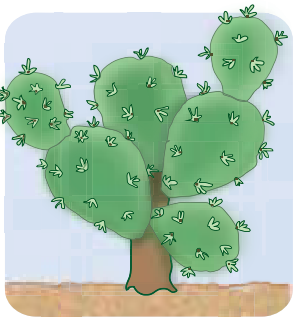


SUB-AERIAL MODIFIED
e.g. Eichhornia

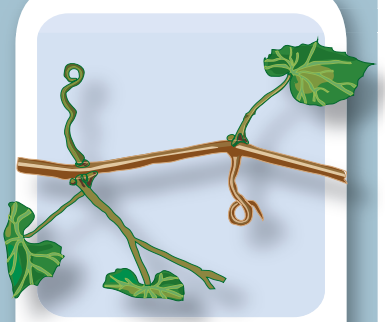
UNDERGROUND STEM
e.g. ColoCasia

Modification of Leaf

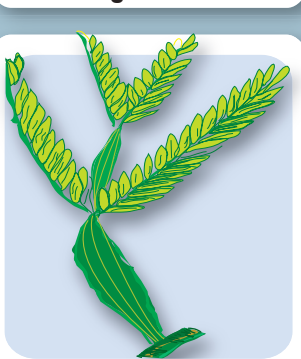
Leaves have changed themselves to adopt to their environment



SPINES
e.g.Opuntia



TENDRILS
e.g.Pisum



PHYLLODE
e.g. Acacia

TRAPS
e.g. Nepenthus

ACTIVITY 7

Aim: To study the modification of root.

Materials Required: Sample / Charts of radish, carrot, beet root, sweet potato, stilt roots and pneumatophores.

Procedure: Carefully observe the shape of each specimen.

Observation: Draw the diagram and observe the morphological differences between the samples.

b. Mechanical Support

Look at a banyan tree. It seems to have many trunk, supporting it. However many of them are actually roots. As the banyan tree is large and huge, it needs support so that it does not tilt and fall down. Many plants require such additional support. Such plants develop roots on their aerial parts to provide mechanical support. These roots grow downward and act as supportive organs. There are three types of modified roots for support.

Prop roots

Roots are modified to provide mechanical support as seen in banyan tree. These roots grow vertically from horizontal branches of a tree.

Banyan

Stilt roots

In sugar cane and maize, adventitious roots arise from the nodes in cluster at the base of the stem. These roots are called stilt roots which give additional support.

Sugar cane

Climbing roots

In betel and black pepper, nodes or internodes bear roots which help in climbing.

Betel

A root growing from a location other than the underground, such as from a stem or leaf is called as adventitious root

c. Breathing roots or Respiratory roots

Avicennia is a tree which grows in mangroves or swamps. They have roots which are seen above the ground for the purpose of gaseous exchange. These roots are erect, peg like structures with numerous pores through which air circulates. These roots are called **breathing roots or pneumatophores.**

Avicennia

Vanda is an epiphytic plant, which grows on trees. The velamen tissue present in the epiphytic root absorbs moisture to perform photosynthesis.

Vanda

d. Haustorial roots

Roots may also perform some special functions. Haustoria or **sucking roots**, are one such example. Cuscuta a parasite plant, climb the trees and other vegetation and use the haustorial roots to penetrate the tissue of the host plant and suck nutrients from them. They are usually found in parasitic plants that depend on the host plants for nutrients.

Cuscuta

5.4.2 Modification of stems

Can you guess what is common between ginger, onion bulb and potatoes. All three are stems. Some plants have their stems modified for storing food and for vegetative propagation. Modified stem may be aerial, subaerial or underground stems.

a. Aerial Modifications

Phylloclade

In dry climate, conserving water is a challenge. Water evaporates from the surface. If the surface area is larger, evaporation would be more and if the surface area is smaller, the evaporation will be less. Plants with many leaves have more surface area. **Cactus** hence

Cactus

has a thick stem which does most of the food production through photosynthesis and leaves are reduced to small spines with less surface area.

b. Sub – aerial Modifications

Stem of some plants remains sub – aerial which grow horizontally on the surface of the soil for the purpose of reproduction. There are four types.

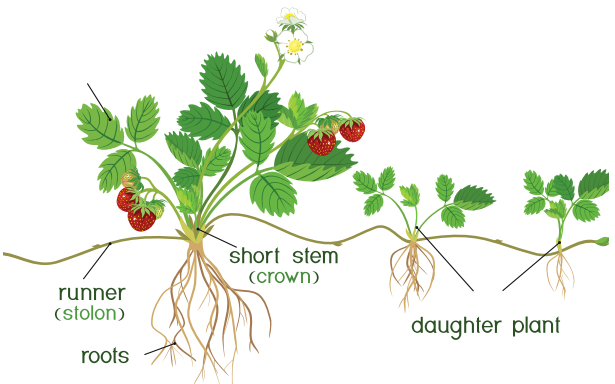
Runner

The stem which grows laterally on the surface of the soil, breaks up to produce roots where it touches the ground to give rise **to new plants. E.g. Centella (Vallarai)**

Centella

Stolon

Stolon is a slender branch of the stem that grows upwards to some distance and then bends towards the ground. Upon touching the ground, it gives rise to a new plant. **E.g. Wild strawberry**



Wild strawberry

Sucker

Sucker is a short and weak lateral branch that grows diagonally upwards and directly gives rise to a new shoot. **E.g. Chrysanthemum**

Chrysanthemum

Offset

An offset is a short and thick branch that arises from the axial part of a leaf. It has thick internodes. It produces a tuft of leaves and cluster of small roots below. **E.g. Eichhornia**

Eichhornia

c. Underground modifications

In aerial and sub aerial modifications, stem has indefinite growth. In underground modified stem, whole stem is burried under the ground and it has definite growth. Usually stem grows above the ground, but there are some stems that grow under the ground to store food. These underground stems swell and become thick. There are four types of underground stems. They are:

1. Rhizome
2. Corm
3. Tuber
4. Bulb

1. Rhizome

It is an underground thick stem with nodes and internodes with scale leaves at the node. It grows horizontally and has an irregular shape. Rhizome have buds. It gives rise to new stem and leaves. **E.g. Ginger and Turmeric**

Turmeric

2. Corm

This underground stem is round in shape and flat at the top and bottom. It is a condensed form of rhizome and bears one or more buds in the axils of scale leaves. Daughter plants arise from their buds. **E.g. Colocasia**

Colocasia

3. Tuber

It is an enlarged, spherical underground stem that stores food. It has many dormant buds on its surface known as 'eyes'. If we plant a part of tuber with the bud, it grows into a new plant. **E.g. Potato**

Potato

4. Bulb

It is a condensed stem which is disc like and stores food in the fleshy leaves. The bulb has two types of leaves.

- Fleshy Leaves
- Scaly Leaves

The upper part of the stem has a terminal bud and it is covered by many scaly leaves. The inner fleshy leaves store food as seen in garlic and onion.

Onion

ACTIVITY 8

Aim: To study the modification of stem

Materials Required: Specimens of ginger, potato, onion, mint, bougainvillea, acacia, opuntia and locally available specimens.

Procedure: Observe the external morphology of each specimen.

Observation: Draw diagram and bring out the differences and their function in each type of stem modifications.

5.4.3 Modifications of Leaf

Plants have changed themselves to adapt to the environment they grow. One of them is the modification of leaves. Leaves of several plants get modified into different form based on the purpose and environment.

1. Spines

Leaves are reduced to spines, and the stem is modified into green succulent part to perform photosynthesis. **Eg. Opuntia**

Opuntia

2. Tendrils

In climbers, the leaf of plant are modified into elongated structure to help the plants climb efficiently.

- ***Gloriosa superba*** – Leaf tips are modified into tendrils.
- ***Pisum sativum (Pea)*** –Terminal leaflets are modified into tendrils.

Pisum sativum

3. Phyllode

In Acacia auriculiformis, petioles expand to form leaf like structure. They carry out the function of leaf (Photosynthesis).

Acacia

4. Traps

Plants that grow in nitrogen deficient places adapt themselves well to get it. In **Nepenthes,** the leaves are modified into a flask like structure, which is used to attract insects and other tiny animals. The inner wall of the leaf secretes digestive enzymes that help to digest the insects and extract the nitrogen needed for the plant.

Nepenthes

Points to Remember

- ❖ Reproduction is an essential function of living organisms. In plants there are two types of reproduction – asexual reproduction and sexual reproduction.
- ❖ In flowering plants, flowers are the reproductive organs. They produce fruits and seeds through pollination and fertilization.
- ❖ The male reproductive organ of a flower is androecium and the female reproductive organ of a flower is gynoecium.
- ❖ Transfer of pollen grains from the anther to stigma is called pollination. There are two types of pollination - self pollination and cross pollination.

- ❖ Agents like wind, water, insects and animals are helpful for pollination and are known as pollinators.
- ❖ After pollination, the fusion of male and female gametes takes place. It is called fertilization. After fertilization, ovary becomes the fruit and ovule becomes the seed.
- ❖ To perform the special function other than the normal function, the root, stem and leaf externally modify themselves according to the environment. So, they change their size, shape and colour. These are called the modification of root, stem and leaves.

Evaluation

O18NA

I. Choose the appropriate answer.

1. Vegetative propagation by leaves takes place in
   a. bryophyllum b. fungi
   c. virus d. bacteria
2. Asexual reproduction in yeast is
   a. spore formation b. fragmentation
   c. pollination d. budding
3. Reproductive part of a plant is
   a. root b. stem c. leaf d. flower
4. Pollinators are
   a. wind b. water c. insect d. All the above
5. Climbing roots are seen in
   a. betel b. black pepper
   c. Both of them d. None of them

II. Fill in the blanks.

1. The male reproductive part of a flower is _____.
2. _____ is the basal swollen part of the gynoecium.
3. After fertilization the ovule becomes _____.
4. Breathing roots are seen in _____ plants.
5. Onion and garlic are example for _____.

III. State true or false. If false, correct the statement.

1. A complete flower has four whorls.
2. The transfer of pollen to the stigma is known as pollination.
3. Conical shaped root is carrot.
4. Ginger is an underground root.
5. Leaves of Aloe vera are fleshy and store water.

IV. Match the following

Petal	Opuntia
Fern	Chrysanthemum
Phylloclade	Attracts insect
Hooks	Spore
Sucker	Bignonia

V. Answer very briefly.

1. Write two types of reproduction in plants.
2. What are the two important parts of a flower?
3. Define – Pollination.
4. What are the agents of pollination?
5. Give example for Corm and Tuber
6. What is tendril?
7. What are thorns?

VI. Answer briefly.

1. Differentiate bisexual flower from unisexual flower?
2. What is cross pollination?
3. Write notes on phyllode.

VII. Answer in detail.

1. Write a brief account on pollination.
2. Explain the underground stems.

VIII. Higher Order Questions.

1. Ginger is considered to be a stem, not a root. Why?
2. What will happen if pollen grain of rose gets deposited on stigma of lily flower? Will pollen germination takes place? Why?

IX. Consider the following statements and choose the correct one.

1. **Assertion**: Pollination and fertilization in flowers produce fruits and seeds.

   Reason: After fertilization the ovary becomes fruit and ovule becomes seed.

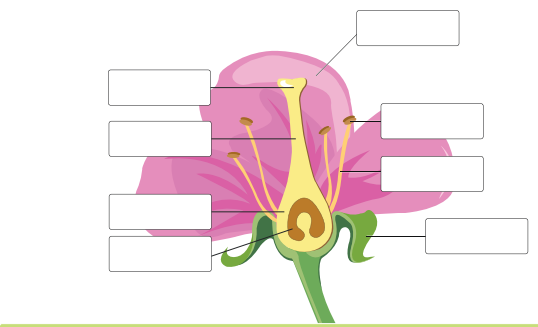
2. **Assertion**: An example for conical root is carrot.

   Reason: It is an adventitious root modification.

   a. Assertion is incorrect, Reasoning is correct.
   b. Assertion is incorrect, Reasoning is incorrect.
   c. Assertion is correct, Reasoning is correct.
   d. Assertion is correct, Reasoning is incorrect.

X. Picture based question.

i. Label the picture given below.



Stigma Pistil Filament Ovule Sepal Stamen
Petal Style Anther Ovary

ii. Identify the four plants shown in the following table. Name the different modifications in each of them.

Name	Modification
Garlic	
Turnip	
Rose plant	
Maize	

ICT CORNER

Reproduction and Modification in Plants

Let's label the parts of the flower.

PROCEDURE :

Step 1: Use the URL to reach stimulation page. Click 'Run adobe flash' to launch the simulation.

Step 2: Select 'OK' button to run the activity.

Step 3: Drag a Stamen into the labelled box. Then click 'OK' button.

Step 4: Read the instructions at the top of the screen to do the activity.

Step 5: Click 'Reset' to refresh.

Step 1

Step 2

Step 3

Step 4

Reproduction plants URL:

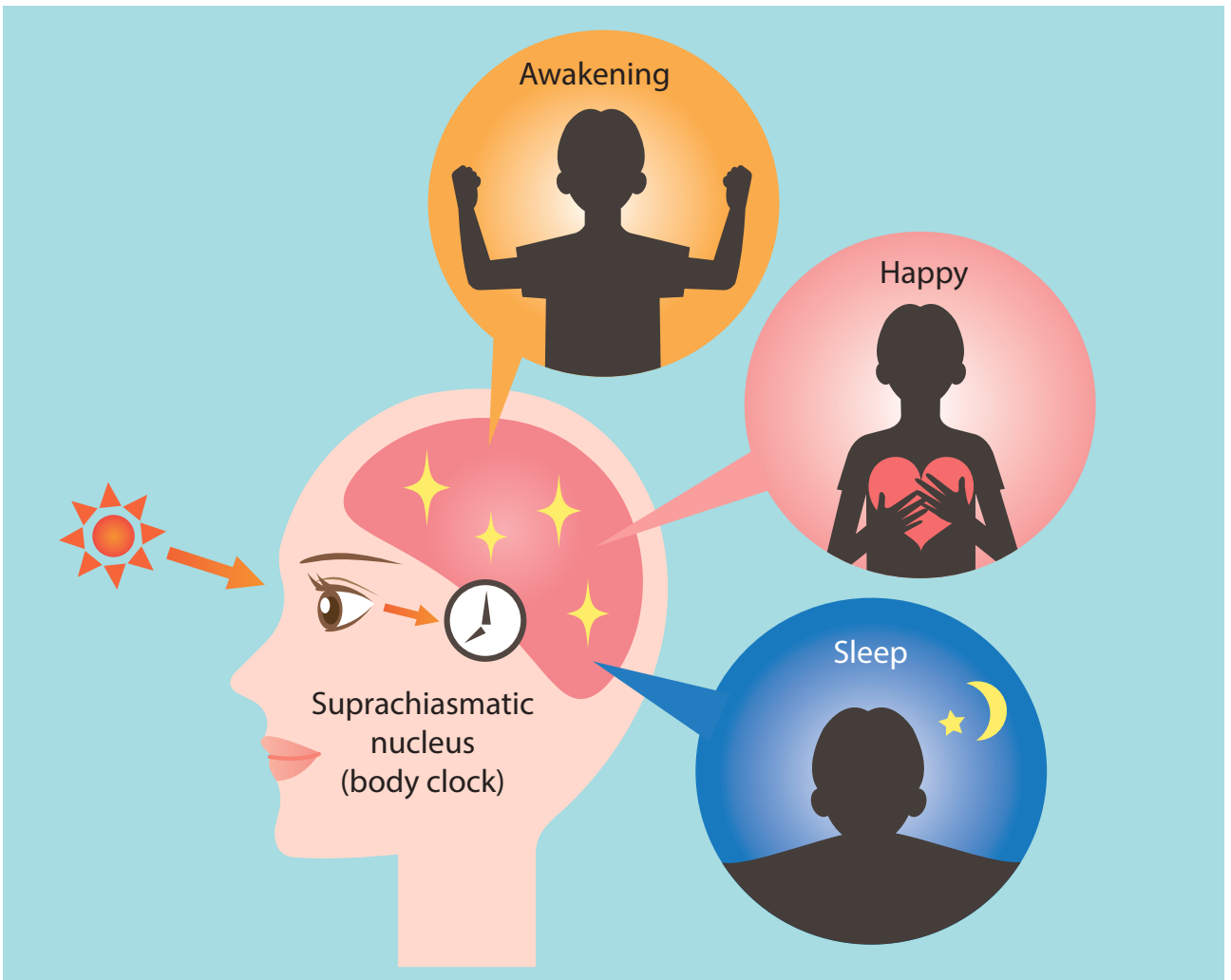
http://www.sciencekids.co.nz/gamesactivities/lifecycles.html

*Pictures are indicative only

*If browser requires, allow Flash Player or Java Script to load the page.

Unit 6

Health and Hygiene



Learning Objectives

After studying this unit, students will be able to:

- describe ways to take care of the body.
- know how to take care of the teeth, eye, hair and follow the hygienic habits.
- understand the communicable and non-communicable diseases.
- know and understand some common ailments and the remedies for them.
- know first aid and safety measures.

Introduction

Have you ever taken leave from the school due to sickness? What happens exactly when we become sick? Sometimes, we feel good even without taking any medicines and sometimes we need to consult a doctor and take regular medicines to be healed. Why is it so?

To prevent and treat sickness successfully, it is necessary to have complete understanding of the common sicknesses in the area and the combination of things that caused them. This lesson may help you to understand the various causes of sickness. In this lesson we are going to study about health and hygiene, care of the body, diseases, health problems of children and safety.

6.1 Hygiene

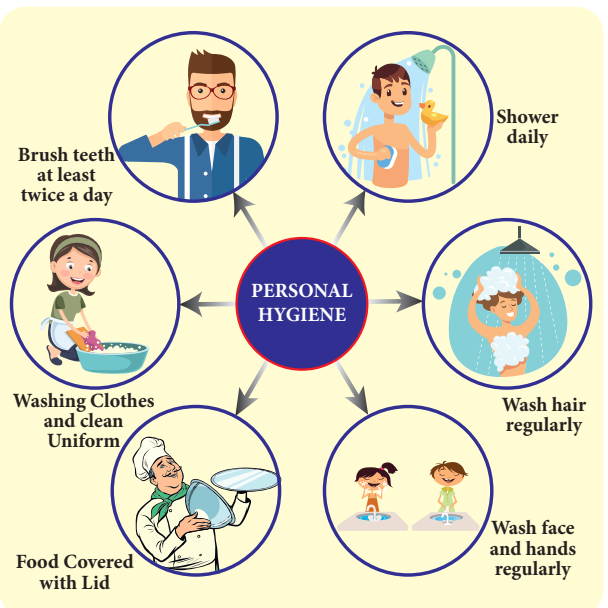
Health is the best wealth. If you have good health, you will have a sound mind and you will gain good knowledge and wealth also. Health refers to a state of a sound mind and body free from any sickness or ailment, stress and problems. In simple words, health refers to the physical, emotional and psychological well-being of a person. To maintain good health, you should follow good hygiene, eat nutritious food, do exercise, take rest and have a sound sleep.

Hygiene refers to the good habits and their practices which are followed to prevent diseases, maintain good health, especially through cleanliness, consumption of safe drinking water and proper disposal of sewage. It refers to all those activities that are done for improving and maintaining good health and sound mind.

Maintenance of personal and environmental hygiene is called cleanliness. In simple words, it refers to the state of being clean which is essential for good health. To protect us from diseases it is essential to maintain good health by taking regular bath, cleaning the clothes and surroundings and also avoiding unhygienic food consumption.

6.1.1 Personal hygiene

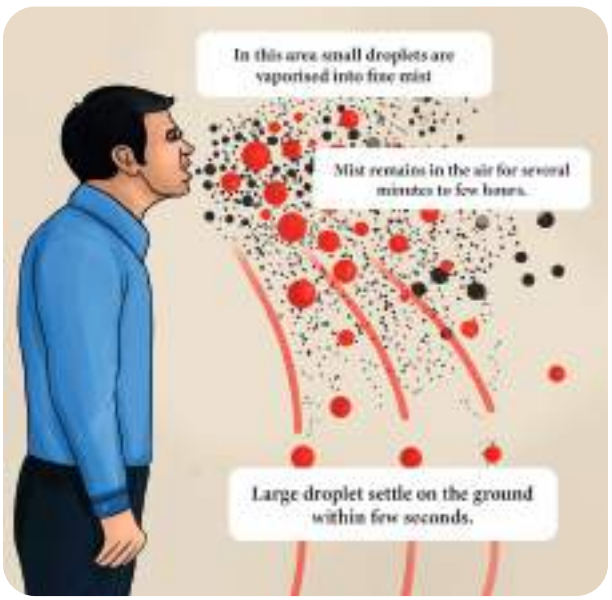
Personal hygiene is defined as the branch of health which is concerned with the individual's adjustment to the physiological needs of the body and mind for the attainment of the maximum level of health. It also refers to the cleaning and grooming of the body.


PERSONAL HYGIENE
Brush teeth at least twice a day
Shower daily
Washing Clothes and clean Uniform
Wash hair regularly
Food Covered with Lid
Wash face and hands regularly

Cold and flu are some of the common communicable diseases. They are caused not only by bacteria but also by virus. When you have cold and flu, you may also have running nose, cough, sore throat, and sometimes fever or pain in the joints. For some, this condition may also lead to mild diarrhoea.

What will happen, if cold affected friend/ classmate of you, sneezes or cough in front of you? When he sneezes some secretions may come out of his nose. Secretions oozing out

from the nose may contains the bacteria or virus. When the patient touches some other object or someone else after touching the nose, the virus is transferred. When the patient sneezes or coughs the virus comes out with the droplets and become airborne. Hence, it is a good practice for the patient with cold and flu to use a hand kerchief to blow the noses and also wash the hands often to ensure that they do not accidentally spread the virus to others.


In this area small droplets are vaporised into fine mist
Mist remains in the air for several minutes to few hours.
Large droplet settle on the ground within few seconds.

ACTIVITY 1

List out your daily activities in the given table.

Activities	Number of times in a day
Brush teeth	
Take shower	
Wash hair	
Wash hands and feet	
Wearing Clean clothes / Uniforms	

Do you follow personal hygiene properly? How these activities will keep you physically fit?

6.1.2 Community Hygiene

A community is formed by a group of people living together in a particular area. If the people in a community wish to lead a healthy life, they should maintain basic community hygiene. It can be done by adopting the following measures.

- The surroundings should be kept clean.
- Drains should be covered properly.
- Used water from houses should not be let out into open drains or open areas.

Dengue is spread by mosquitoes of Aedes aegypti caused by DEN-1, 2 virus belonging to the type - flavivirus. It decreases the counting of the blood platelets of human blood and it has a maximum flight range of 50–100 metres in and around the places.

ACTIVITY 2

Observe the picture and write remedial measures

➢ The domestic wastes should be segregated and properly disposed off safely in separate dust bins provided by the government (Green and Blue).

6.2 Care of the body

Human body is a massive miracle. It consists of organs and systems, which function continuously. Our body is compared to a machine. Human body works well with proper maintenance and guidance. For smooth functioning, all the parts of the body should work in unison. The digestive system, circulatory system and muscular system are the core systems that should be in synchronization and function well. We need to keep them well by proper care.

6.2.1 Dental Care

Dental care or broadly speaking oral hygiene is an important aspect of the personal health of an individual. Good oral hygiene implies sound teeth and healthy gums with healthy surrounding tissues. The physical act of chewing food promotes saliva and gastric secretions which help digestion. The act of chewing and tasting is called 'mastication'. It gives pleasure and emotional satisfaction of eating food. Teeth is essential for good appearance and clear speech also.

- Brushing two times a day, will prevent the formation of tartar and plaque on your teeth and gums.
- When you floss, it will remove food particles, plaque and bacteria which build up between your teeth (When you start flossing, your gums may bleed a little bit, but after few days that will be stopped. It should be started only with proper medical guidance).

Diseases affecting the teeth

Failure to have oral hygiene results in diseases affecting the teeth. Some of the diseases affecting the teeth and gums, their causative agents and remedial measure are given below in the table.

6.2.2 Eye Care

Eyes are an important organ of our body. They are considered as windows to the world. Eyesight is the most important sense. 80% of what we perceive comes through the sense of sight. Protecting the eyes, can

Table 6.1 Diseases affecting teeth

Sl. No.	Name of the Diseases	Causative Agents	Impacts / Consequences	Remedial measures
1	Bleeding gums	Vitamin C deficiency	Bleeding of the gums	Eating citrus fruits
2	Tooth decay	Bacteria in teeth	Bacteria produce acids	Brushing and flossing the teeth can prevent decay.
3	Periodontitis	Tobacco chewing	Severe form of gum disease ruin the bones, gums, and other tissues	Chewing type of tobacco should be avoided. Eat a well-balanced diet.

reduce the odds of blindness and vision loss. We should protect our eye from the diseases, surroundings and climate condition.

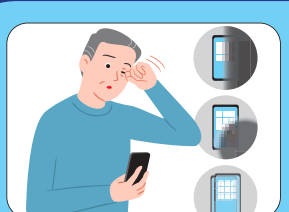
Diseases affecting Eye

Diseases affecting the eyes and the remedial measures are given below.

Table 6.2 Diseases affecting eye

S.No.	Name of the Disease	Causative Agents	Impacts/Consequences	Remedial measures
1.	Night Blindness	Lack of vitamin A. Disorder of the cells in your retina	Makes it hard to see well at night or in poor light.	Eat foods rich in vitamins like carrots, papaya.
2.	Conjunctivitis (Pink eye)	Caused by a virus and bacteria	One or both eyes can be affected. Highly contagious; can be spread by contamination and sneezing.	Antibiotic eye drops or ointments, home remedy
3.	Colour blindness	Genetic condition	• Difficulty in distinguishing between colours. • Inability to see shades or tones of the same colour.	There is no known cure for colour blindness. Contact lenses and glasses with filters.

ACTIVITY 3



Observe the pictures and tick do's and don'ts in the given tables

Sl . No.	Practices	I Do	I Don't do
1.	Do you rub the eyes?		
2.	Do you watch TV/work on computer for a long time?		
3.	Do you use cold water for cleaning your eyes?		
4.	Do you like eating carrot?		
5.	Do you regularly eat fruits like orange, sweet lemon and lemon?		

In the above checklist what do you understand?

6.2.3 Hair Care

The condition of the hair reflects to some extent the nutritional status and general health of the body. Thin, sparse hair and the loss of hair indicates a poor nutritional status. The deficiencies in diet, physical and mental illness of various kinds may also lead to premature greying of hair.

The hair follicles from which the hair grows produce oil which keeps the hair smooth. The sweat and the dead skin cells come off the scalp. The oil, sweat and dead cells all add together and can make the hair greasy and look dirty unless it is washed regularly.

Keeping hair clean and healthy

- Regular hair wash and massage of the scalp will remove the dead skin cells, excess oil and dust.
- Rinsing the hair well with clear water and using good toothed comb for hair dressing is highly essential for the maintenance of hair.

6.3 Diseases

A disease is the functional or physical change from a normal state that affects the health of a person by causing disability or discomfort. The following are the conditions that could lead to the development of disease in an individual.

- Infection caused by disease-causing microbes.
- Lack of balanced diet.
- Poor lifestyle and unhealthy habits.
- Malfunctioning of one or more body parts or organs.

The prevention and treatment of diseases can be considered in two groups for their better understanding. They are communicable and non-communicable disease.

6.3.1 Communicable Diseases

Communicable diseases are those diseases that spread from one person to another. Healthy persons must be protected from people with communicable diseases. Diseases spread through contaminated air, water, food or vectors (insects and other animals).

a. Diseases caused by Bacteria

Communicable diseases like tuberculosis, cholera and typhoid, are caused by bacteria. These diseases spread through air, water and some other organisms.

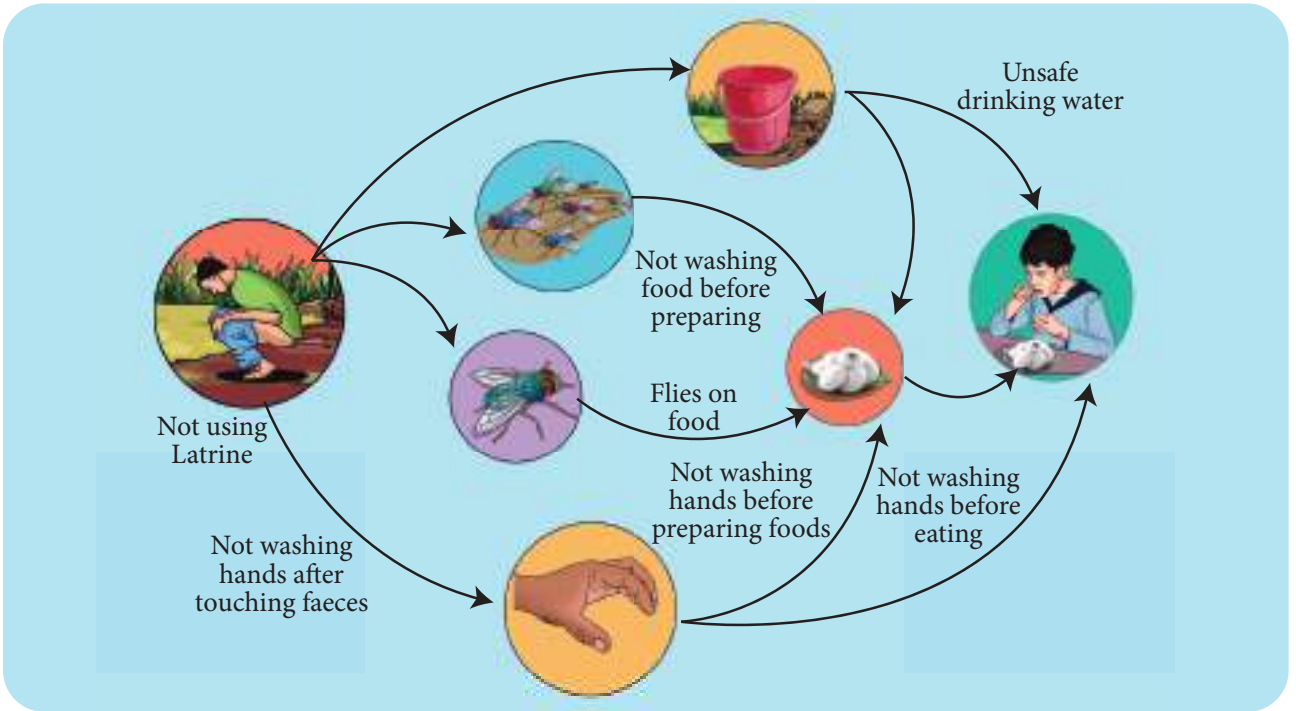
1. Tuberculosis

Tuberculosis (TB) is caused by ***Mycobacterium tuberculae*** and spreads from one person to another person through air, spitting, prolonged contact and sharing materials of the patient. The symptoms are fever, weight loss, chronic cough, bloody spitting and difficulty in breathing.

Mycobacterium tuberculae

Prevention and treatment

- BCG vaccination.
- Giving special attention to the patient.
- Regular medication like DOT.



2. Cholera

Cholera is caused by Vibrio cholerae and spread through the consumption of contaminated food or water. The symptoms of cholera is vomiting, severe diarrhoea and cramps in legs.

Vibrio cholerae

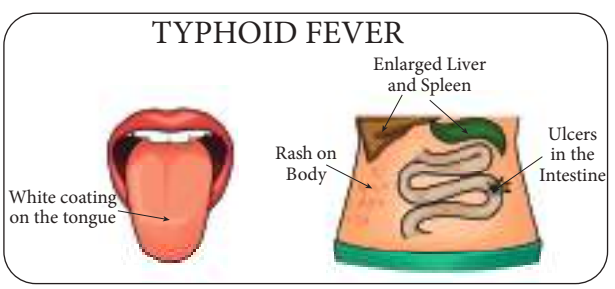
Prevention and treatment

- Good hygienic practices like washing hands before eating.
- Avoid eating uncovered food from street vendors.
- Drinking boiled water.
- Getting vaccination against cholera

3. Typhoid

Typhoid is caused by *Salmonella typhi* and spreads by contaminated food and water. The symptoms are anorexia, headache, rashes on abdomen, dysentery and high fever up to 104°F.

Salmonella typhi



Prevention and treatment

- Drinking boiled clean water
- Proper disposal of sewage
- Vaccination

b. Diseases caused by Virus

Viral diseases are extremely widespread infections caused by many type of viruses. Some diseases caused by viruses are hepatitis, chickenpox and rabies.

1. Hepatitis

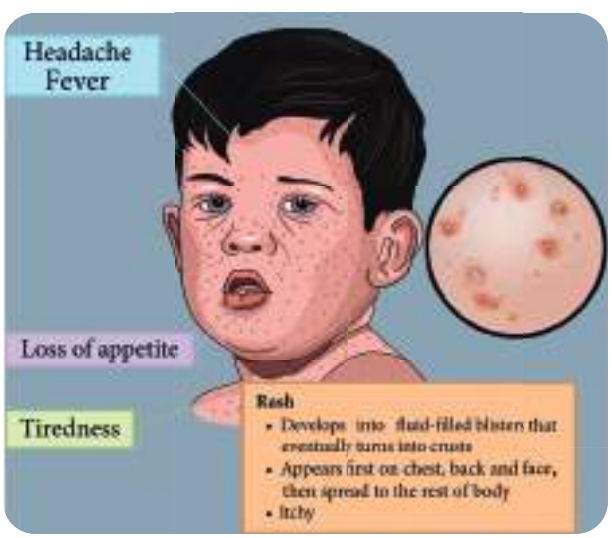
Hepatitis is one of the most dangerous and fatal diseases caused by Hepatitis virus- A, B, C, D, E. Its mode of transmission is contaminated water, sharing of needles and blood transfusion. The symptoms of hepatitis is loss of appetite (anorexia), vomiting, eyes and urine turning to yellow colour.

Prevention and treatment

- Drinking boiled water
- Proper cleaning of hands

2. Chickenpox

Chickenpox also known as varicella is a highly contagious infection caused by the varicella zoster virus. This disease spreads through air and contact with an infected person. Its symptoms are appearance of rashes on the whole body, fever, headache and tiredness.


Headache
Fever
Loss of appetite
Tiredness
Rash
• Develops into fluid-filled blisters that eventually turns into crusts
• Appears first on chest, back and face, then spread to the rest of body
• Itchy

Prevention and treatment

- The chickenpox (varicella) vaccine is the best way to prevent chickenpox
- Special attention should be given to the infected persons.

c. Rabies

Rabies is a fatal disease which is transmitted by the bite of the infected dog, rabbit, monkey, cat etc. The virus present in the saliva of dog enters the brain via neurons. The symptoms of rabies are hydrophobia (extreme fear for water), fever for 2 – 12 weeks and exaggerations in behaviour.

Prevention and treatment

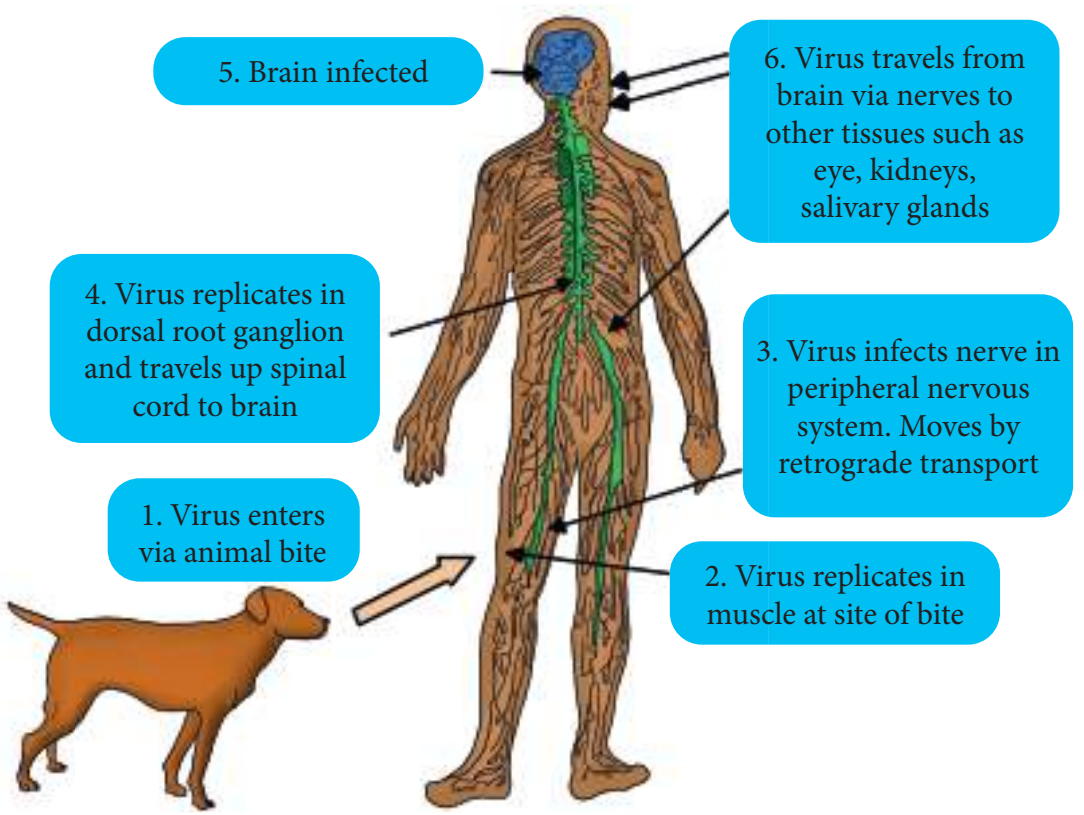
- In early stages rabies is very difficult to detect.
- After an animal is bitten it usually takes two to twelve weeks to show any symptoms and it may take as long as two years also.
- Fatality can be prevented by timely vaccination before the onset of symptoms.

ACTIVITY 4

Visit a nearby Primary Health Centre and collect information about vaccination given to children of 0-15 years. Meet a doctor or a health worker in the hospital and enquire about the following.

- The types of vaccines available there.
- Can disease be prevented by their usage?
- The age at which it should be given.

Rabies


5. Brain infected
6. Virus travels from brain via nerves to other tissues such as eye, kidneys, salivary glands
4. Virus replicates in dorsal root ganglion and travels up spinal cord to brain
3. Virus infects nerve in peripheral nervous system. Moves by retrograde transport
1. Virus enters via animal bite
2. Virus replicates in muscle at site of bite

Vaccine

Vaccine is a biological preparation that provides active acquired immunity to a particular disease. Vaccines like (BCG, Polio, MMR) are given at early childhood to protect from other diseases.

6.3.2 Non-communicable diseases

Non-communicable diseases do not spread from person to person. They are caused by other factors. Therefore, it is important to know which diseases are communicable and which are not. They are never caused by germs, bacteria, or other living organisms that infect the body. Antibiotics or medicines that fight against germs do not help to cure non-communicable diseases. Some of the non-communicable diseases are explained below.

a. Wearing out of body parts

Rheumatism, heart attack, epileptic seizures, stroke, migraine headache, cataract and cancer.

b. External harmful agents entering the body

Allergies, asthma, poisons, snakebite, cough from smoking, stomach ulcer, alcoholism.

c. Lack of trace elements in the body

Anemia, pellagra, night blindness and xerophthalmia, goiter and hypothyroidism.

d Malnutrition

Nutritious food is needed for a person to grow well, work hard, and stay healthy. Many common sicknesses are caused by malnutrition.

DO YOU KNOW?

Leucoderma is a non – communicable diseases caused by partial or total loss of pigmentation in the skin **(melanin pigment).** This condition affects people of any age, gender and ethnicity. There is no cure. It does not spread by touching, sharing food or sitting together.

6.4 Specific health problems of children

Anaemia

It is caused by eating food with less iron content and can also be caused due to feeding some other foods instead of breast milk. Severe anaemia in children may lead to hookworm infection, chronic diarrhoea and dysentery. In the recent days, school going children, especially girls are affected by anaemia. The Government of Tamil Nadu provides iron folic tablets to all the girls in the schools of all areas every week.

The signs of anaemia

- Pale or transparent skin, the inner surface of eye lids are pale, white fingernails, pale gums, weakness and fatigue.
- In severe cases, face and feet may be swollen, the heart beat is rapid and with shortness of breath.
- Children and women who eat mud are usually anaemic.

Treatment and prevention of anaemia

Anaemia can be preventing by takes proper food and diet.

DO YOU KNOW?

As a general rule, iron supplements should be given orally, not to be injected, because it is dangerous.

Food

Moringa leaves, dates, liver (sheep and chicken), green, green leafy vegetables like beans, peas, lentils and greed banana.

Pills

Cod liver oil tablet, Ferrous sulphate.

6.5 Safety and First Aid

YSD28

First aid is the immediate treatment given to the victim of trauma or sudden illness before medical help is made available. First aid is important for following reasons.

- It saves the life.
- It prevents further bleeding and determine the condition of the patient.
- It relieves the pain.
- It provides a medical care available at the earliest.

6.5.1 Burns

The tissue damage caused by heat, chemical, electricity, sunlight or nuclear radiation is known as burns. Mostly burns are caused by scalds, building fires, flammable liquid and gases. There are three types of burns, according to degree of burning.

- First-degree burns affect only the outer layer (called the epidermis) of the skin.

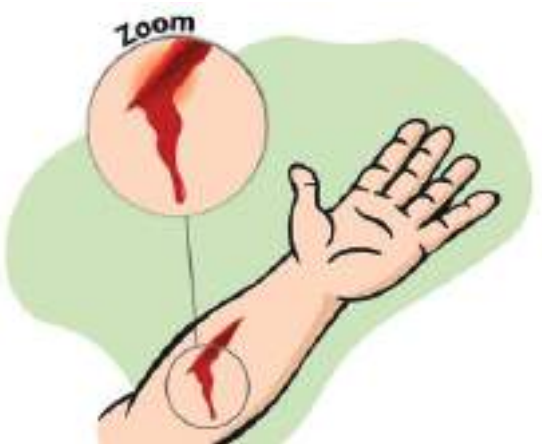
- Second-degree burns damage the epidermis and the layer beneath it (called the dermis).
- Third-degree burns involve damage or complete destruction of the skin to its full depth and damage to underlying tissues also. People who experience such burns often require skin grafting.

First aid for Burning

In case of minor burns, the affected area should be washed with cold water and an antiseptic cream should be applied. In case of severe burns, where deeper layers of tissues get destroyed and blisters appear, use of water should be avoided. The burnt area should be covered with a clean non-sticking cloth or bandages. Larger burns need immediate medical attention. It is very important to keep a fire extinguisher readily available.

6.5.2 Cut and Scratches

Cuts and scratches are the areas of damage on the surface of the skin. A cut is a line of damage that can go through the skin and into the muscle tissues below, whereas a scratch is surface damage that does not penetrate the lower tissues. Cuts and scratches may bleed or turn red, become infected and leave scars.



First aid for cuts

For minor cuts, the affected area should be washed with cold running water and cleaned with an antiseptic liquid. Then an antiseptic cream should be applied on the wound and sterilized bandage should be tied to prevent infection. If the cut is deep, a clean cotton pad should be placed on the cut and pressed, and the injured person should be taken to a doctor immediately.

6.6 Basic cleanliness and protection

The most important thing is to help anybody, but you must also protect yourself from HIV and other blood-borne diseases

when you help someone who is bleeding. You should wear gloves or a clean plastic bag on your hands. Be careful not to prick yourself with needles or other sharp objects around the person you are helping.

Points to Remember

- ❖ Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.
- ❖ Diseases that are caused by pathogens and can be transmitted from an infected person to a healthy person directly or indirectly are called communicable diseases.
- ❖ Diseases that are not caused by pathogens and cannot be passed on by a sick person to a healthy person are called non-communicable diseases.
- ❖ First Aid is the immediate care given to a patient before a medical person arrives.

Evaluation

I. Choose the appropriate answer.

1. Ravi has sound mind and physically fit body. It refers to
   a. hygiene b. health
   c. cleanliness d. wealth
2. Sleep is not only good for our body, but it is also good for
   a. enjoyment b. relaxation
   c. mind d. environment
3. Our living place should be
   a. open b. closed
   c. clean d. unclean / untidy
4. Tobacco chewing causes
   a. anemia b. periodontitis
   c. tuberculosis d. pneumonia
5. The first aid is to
   a. save money b. prevent scars
   c. prevent the medical care
   d. relieve the pain

II. Fill in the blanks.

1. A group of people living together in a particular area is called _____
2. I am green colour box with garbage. I am _____ .
3. Eyes are considered as _____ to the world.
4. The hair follicles produce _____ which keeps the hair smooth.
5. Tuberculosis is caused by the bacterium _____.

III. State true or false. If false, correct the statement.

1. All food should be covered.
2. Chicken pox is also known as leucoderma.
3. Stomach ulcer is a non- communicable disease.
4. Rabies is a fatal disease.
5. First – degree burns damage the whole skin.

IV. Match the following.

Rabies	Salmonella
Cholera	Yellow Urine
Tuberculosis	Cramps in legs
Hepatitis	Hydrophobia
Typhoid	Mycobacterium

V. Analogy.

1. First degree burn : Epidermis :: Second degree burn : _____
2. Typhoid : Bacteria :: Hepatitis : _____
3. Tuberculosis : Air :: Cholera : _____

VI. Consider the following statements and choose the correct option.

1. **Assertion**: Oral hygiene is good.

   Reason: Sound teeth has healthy gums with healthy surrounding tissues.

2. **Assertion**: Chicken pox is a viral communicable disease.

   Reason: It is characterized by rashes on the whole body, fever, head ache and tiredness.

   a) Both A and R are true

   b) Both A and R are false

   c) A is true but R is false.

   d) A is false but R is true.

VII. Answer very briefly.

1. What is hygiene?
2. Write about the right way of protecting the eyes.
3. How to keep your hair clean and healthy?
4. Sobi frequently plays with her mobile. Suggest your ideas to protect her eye from irritation?
5. Give any two communicable diseases, which spread in your locality during monsoon.
6. What first aid will you provide in the case of bruises?
7. Ravi said, Ganga had minor burn, so I washed it with water. Do you agree with his statement? Explain, why?

VIII. Answer briefly.

1. Why first aid is essential?
2. What steps you will follow to keep your teeth healthy?
3. What does this picture mean?

4. Distinguish communicable diseases and non-communicable diseases.
5. Name the mode of transmission of communicable diseases.
6. Your friend says that her hair is thin, spares and lost very often. Suggest your ideas to reduce this problem.

IX. Answer in detail.

1. Write about any three communicable diseases in detail.
2. List the situations in which first aid is given. What would you do if a person suffers from skin burns?
3. How the diseases are transmitted from one person to the other person?

X. Higher order thinking question.

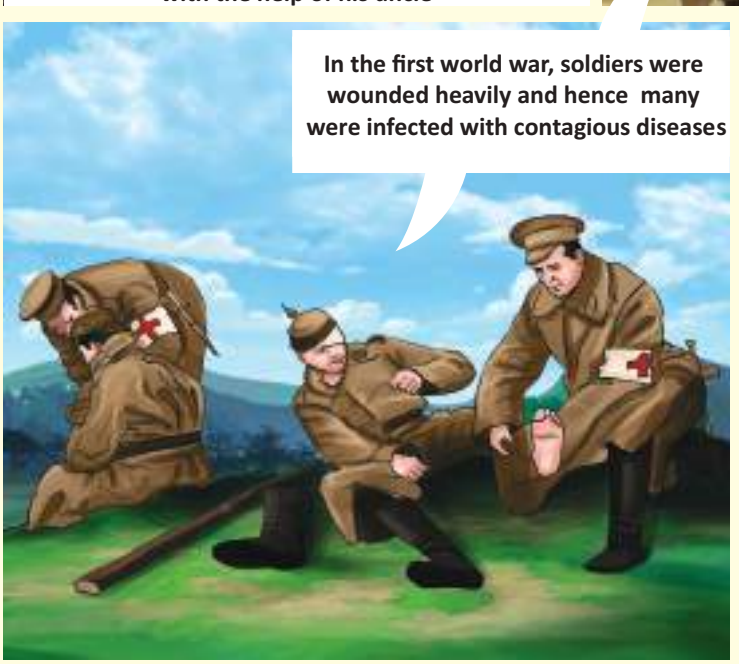
A person is sleeping during day time. Why does this happen to some people that they feel sleepy during day time in office or in the classroom? Have you ever come across such situation? Explain.

Queen of Medicines – Penicillin

Alexander Fleming
(1881 - 1955)

Alexander Fleming did his school education at St. Mary's school in London

As he was very much interested in studying medicine at the age of 20, he joined medical course at St. Mary's Medical College and Hospital with the help of his uncle

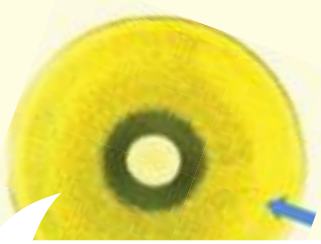


They were neither cured even after applying antiseptics nor their wounds healed

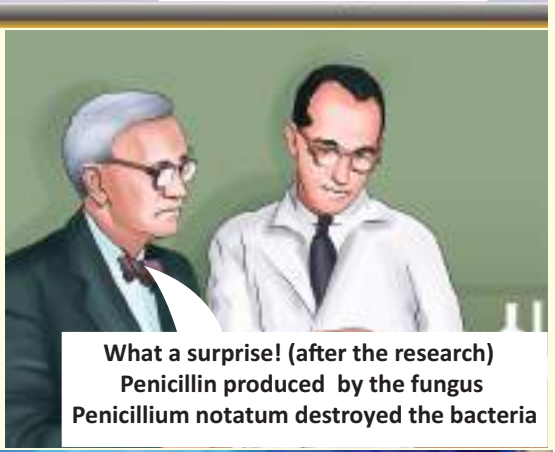
These germs have spread to others too!

The antiseptics reduced immunity. They spread bacteria. So an alternative to this was to be discovered

I cultured staphylococci bacteria in these culture media



What? In this culture media, a mould is formed but and I could not see staphalococci bacteria!



What a surprise! (after the research) Penicillin produced by the fungus Penicillium notatum destroyed the bacteria

The world's first antibiotic penicillin was discovered in 1928. "We are happier in curing millions of soldiers than getting the Nobel prize"

Penicillin cured Pneumenia, Diphtheria and infected wounds. Alexander saved the life of many soldiers and prevented the communicable disease by using penicillin. later, penicillin is used as the universal antibiotic. The discovery of Alexander is known as the 'Queen of Medicines' as the provided great benefits in the field of medicine

Unit 7

Computer - Visual Communication

Learning Objectives

After learning the lesson, students will be able to:

- differentiate a file from a folder.
- know how to create a file and a folder.
- use the system application like 'paint' to create images.
- use the system application like 'photo story' to create video from images.

ARE94

Introduction

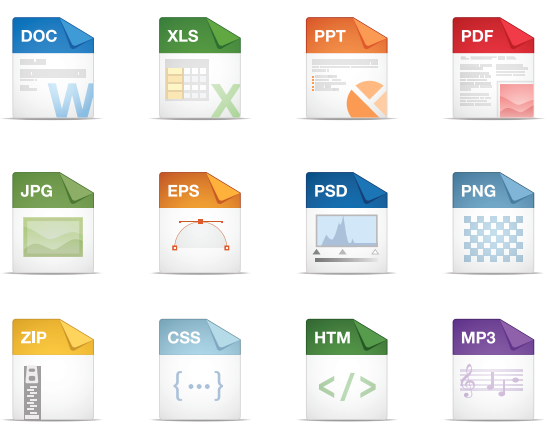
In general, whenever we think of computers, the things that come to our mind are computer screen, keyboard, mouse and CPU. We have learnt about computer and the parts of a computer as introductory part in standard VI. Apart from them, software and hardware also play vital role in the working of computer. Now, we shall learn how to operate the computer.

7.1 File and Folder

The reason we prefer computer is its speed and the ability to store data. How can we save data and information in computer? We can save them in folders which accommodate multiple files or a single file. Let us understand the terminologies like file and folder before moving further.

7.1.1 File

The output we get from any application is commonly referred as 'file'. Therefore, the application for the specific purposes determines the nature of the file.



Files

7.1.2 Folder

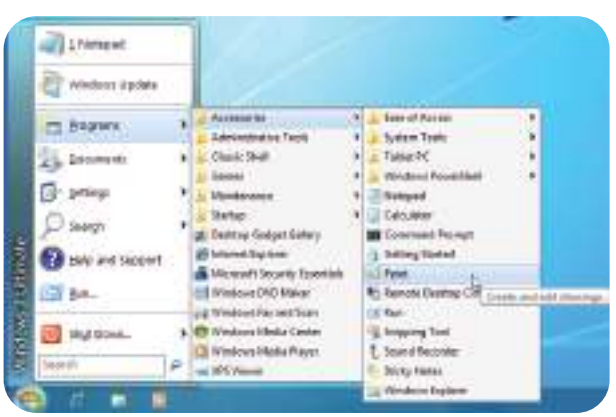
A folder is a storage space that contains multiple files. We can create files as per the user's need. For clear understanding, we can take the example of a bookshelf in a library. The individual book can be considered as a 'file' and the whole set of books in a shelf can be considered as folders. When we right click on the mouse, the pop-up menu appears on the screen with multiple options. Select 'New' option and a secondary menu comes up with another set of options. Select Folder option in the menu. You can now save your file(s) in the newly created folder.

Folder

7.2 Creating Files

More people are using Windows and LINUX operating systems in their computers. We can do many activities like collecting notes, drawing / painting, creating animations / spreadsheets / word docs / PPTs etc.

We use 'Guide Board' to go to unknown places. When we 'On' the computer and click the 'Start' button at the left corner of the computer, it shows the list of all programs in the computer. Now select the required program and create the required files.



If the computer is operating on the Windows OS, we can collect our notes in 'Notepad' application and draw pictures in 'Paint' application. As per its name we can type notes in 'Notepad' and save the created files in a folder. Likewise in the 'Paint' app we can draw and edit pictures. Let us see how we can create image gallery, animations and graphics easily.

7.3 Visual Communication Divices

Pictures and audio-visuals gives us more understanding than teaching and writing on the black board. Is it right?

Instead of saying a story like 'once upon a time there was a king' we can understand the concept easily by seeing the video. Also it registers firmly in the minds of the students. The device which helps in explaining the concepts easily through pictures is known as 'Visual Communication Device'. For example photos, audio – visuals, drawings, animations all these can be created easily with the help of computer. Cinema is a good example for 'Visual Communication Device'.

7.3.1 Photo Gallery and Photostory

You all must have admired the photos in the albums. To beautify photos and edit the photos, photographers are using a software known as 'Photoshop'. Can we make photo gallery only with the help of photos or is there anything more to do with a bunch of photos? We can make photostory. Yes, with the photos we can make a story.

In our primary classes we have studied photo stories like this. Children learn concepts easily through photo stories than by reading words. This type of photo stories can be converted easily into videos with the help of the software 'Microsoft Photostory'.

Microsoft Photostory

To make videos with the help of this software we have to order the photos first, then we have to select a music and keep it in a file.

Step 1

Open the application of 'Microsoft Photostory'. In that select 'Begin a new story' and click on 'Next'.

Step 2

Click **'Import Picture'** in the next screen. Now, the files in our computer will appear. Select 'Saved pictures' for video. There is a provision for editing the picture. If required, we can edit the image and click on 'Next".

Step 3

Now we can input small text which is apt to the pictures. Then click on 'Next' and give animation to the videos. We can give audio effect also to these images. After finishing this click on 'Next".

Step 4

To provide background music, we can select a music file through 'Select Music' and click on 'Next'.

Step 5

Next select a title for the story and select the place where it has to be saved in your computer. Then, through 'Settings', change the format of the video.

Step 6

Now our video is ready to view. Click 'View your story'. You can see your video now.

7.3.2 Graphics and Animation

a. Raster Graphics

The picture or image which is created by Raster Graphics is entered 'as file and data'. Pictures are of two types one is Vector another one is Raster.

Raster Graphics are created on the basis of 'Pixels'. The photos taken by camera and the

photos scanned by a scanner are of the Raster type. When we enlarge this type of photos we could see the pictures as rectangular layers or grids.

Types of Raster Files

- .png (Portable Network Graphics)
- .jpg or .jpeg (Joint Photographics Experts Group)
- .gif (Graphics interchange Format)
- .tiff (Tagged Image File Format)
- .psd (Photoshop Document)

The Software which edit the Raster Graphics is Adobe Photoshop.

b. Vector Graphics

As the Vector Pictures are created on the basis of Mathematics, even when we enlarge the picture its accuracy will not change.

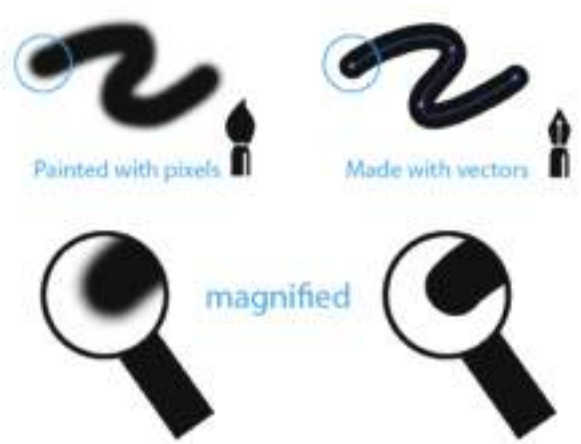
Types of Vector Graphics Files

- .eps (Encapsulated Post Script)
- .ai (Adobe Illustrator Artwork)
- .pdf (Portable Document Format)
- .svg (Scalable Vector Graphics)
- .sketch

The softwares which edit the Vector Graphic Images are:

- Adobe Illustrator
- Sketch
- Inkscape

Creating vector image through Inkscape software



Inkscape software is used to convert image drawn on paper into vector image.

Step 1

First we have to scan the picture we have drawn in the computer.

Step 2

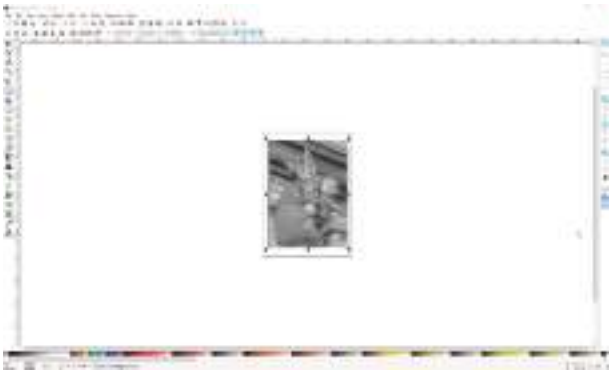
Then we have to open this picture in the 'Inkscape' software. Select the entire picture.

Step 3

Select 'Path' option. From the submenu, select 'Trace Bitmap' option.

Step 4

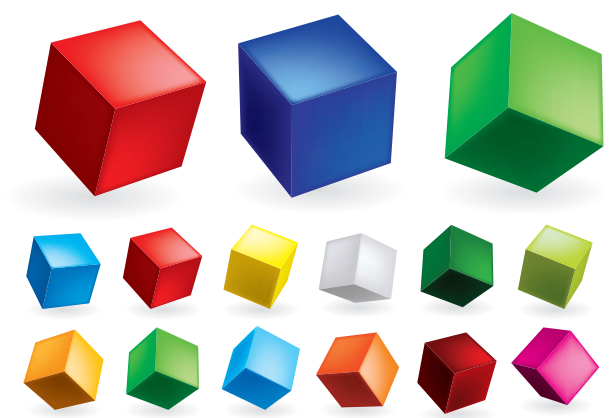
Do corrections in the small screen which appears. Now upload this edited image and click on OK.



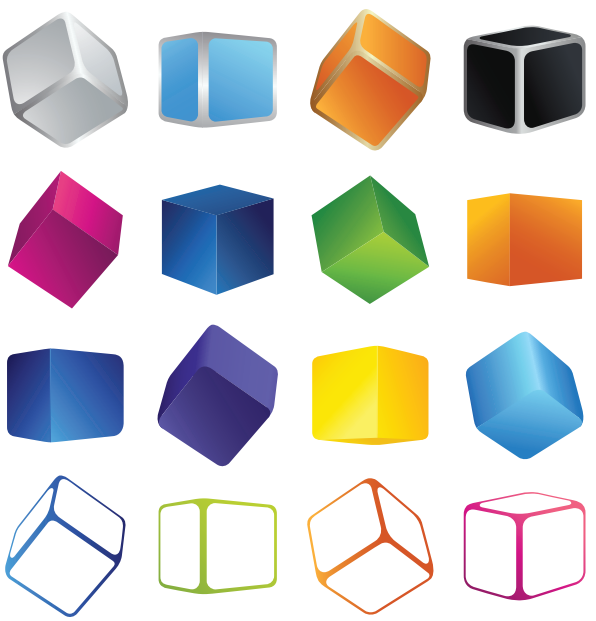
Step 5

Now close the screen of TRACE BITMAP. Now click the picture that appears on the present screen and drag it. You will get the vector graphics of the drawn picture. SAVE it by clicking the 'save button' and save it in your choice of file format.

7.4 Dimensional and 3 Dimensional Images



As soon as we see the above picture we know the difference between the two. The first is TWO DIMENSIONAL (2D) another one is THREE DIMENSIONAL (3D). The two dimensional (2D) images have only the two dimensions - length and height. But three dimensional images (3D) have length, height and width. 3D images appear in front of our eyes like it happens in the real world.



Three dimensional videos will bring the scenes alive before our eyes. Already there are three dimensional films. Now three dimensional games have also got released.

Now there is a new technology - VIRTUAL REALITY in 3D. VIRTUAL REALITY is a technology which shows the computer image as real image. When we see games through this technology we can feel / perceive the setting of the game as real. Now this technology has been introduced in Smart Phones too.

Evaluation

I. Choose the correct answer.

1. Which of the following is an example for animation?
   a) Sound communication
   b) Visual communication
   c) Vector communication
   d) Raster communication
2. Who uses the photoshop software more ?
   a) Teacher
   b) Doctor
   c) Painter
   d) Photographer
3. Which option is used in the Microsoft Photostory to upload the photos?
   a) Begin a Story
   b) Import Pictures
   c) Settings
   d) View your Story
4. Which technology shows the computer-drawn pictures as real picture?
   a) Inkscape
   b) Photo Story
   c) Virtual Reality
   d) Adobe Illustrator
5. Which technology uses pixels to create pictures?
   a) Vector b) Raster
   c) Both d) None
6. Which software is used to create symbols?
   a) Photoshop
   b) Illustrator
   c) Vector Graphics
   d) Photostory

II. Match the following.

Animations	3D
Raster	Visual Communication
Vector	Pixles
Virtual Reality	Microsoft Photostory
Video Story	Illustrator

III. Answer briefly.

1. What is Raster Graphics?
2. Write a note on 2D and 3D pictures.
3. Differentiate between Raster and Vector images.
4. With the help of Microsoft Photostory how will you create a video?

GLOSSARY

Atoms	–	அணுக்கள்
Anion	–	எதிர்மின் அயனி
Asexual Reproduction	–	பாலிலா இனப்பெருக்கம்
Androecium	–	மகரந்தத்தாள் வட்டம்
Anemia	–	இரத்த சோகை
Antiseptic	–	கிருமிநாசினி / நச்சுத்தடை பொருள்
Acceleration	–	முடுக்கம்
Aphelion	–	சூரியனுக்கு தொலைவில் இருக்கும் பூமியின் நிலை (portion)
Astronomy	–	வானியல் பொருட்களைப் பற்றி படிக்கும் இயற்பியல் பிரிவு
Budding	–	மொட்டு விடுதல்
Burn	–	தீக்காயம்
Bruise	–	கன்றிப்போன காயம்
Compound	–	இரண்டு அல்லது அதற்கு மேலான, வேறுபட்ட மூலக்கூறுகளிலான சேர்மம்
Chemical formula	–	அணுக்கள் மற்றும் மூலக்கூறுகளைக் குறிக்கக்கூடிய குறியீடு
Cation	–	நேர்மின் அயனி
Coloumb	–	மின்னூட்டத்தின் அலகு
Calyx	–	புல்லி வட்டம்
Corolla	–	அல்லி வட்டம்
Communicable disease	–	தொற்று நோய்கள்
Cross Pollination	–	அயல் மகரந்தச் சேர்க்கை
Centre of gravity	–	ஈர்ப்பு மையம்
Celestial bodies	–	வானியல் பொருள்கள்
Ductile	–	கம்பியாக மாற்றக்கூடிய தன்மைவாய்ந்த உலோகம்
Density	–	ஓரலகு பருமனில் அடங்கியுள்ள மொத்த பொருளின் நிறை
Distance	–	தொலைவு
Displacement	–	இடப்பெயர்ச்சி
Derived quantities	–	அடிப்படை அளவுகளிலிருந்து தருவிக்கப்பட்ட அளவுகள்
Element	–	ஒரே வகை அணுக்களினால் ஆன தனிமம்
Equilibrium	–	சமநிலை
Free radical	–	முடிவுறா மூலக்கூறு
Fragmentation	–	துண்டாதல்
Fertilization	–	கருவுறுதல்
First aid	–	முதலுதவி

Gynoecium – சூலக வட்டம்

Gingivitis – பல்ஈறு வீக்கம்

Ion – அயனி

Inter – atomic distance – இரு அணுக்களுக்கு இடையே உள்ள தொலைவு

Matter – அணு மற்றும் மூலக்கூறுகளினால் ஆன பருப்பொருள்

Malleable – தகடாக மாற்றக்கூடிய தன்மைவாய்ந்த உலோகம்

Mass – பருப்பொருள்களில் அடங்கியுள்ள பொருளின் அளவு

Melting – திடப்பொருள் திரவமாக மாறக்கூடிய நிகழ்வு

Matter – பருப்பொருள்

Molecules – மூலக்கூறுகள்

Meditation – தியானம்

Measuring container – அளவுகள் குறிக்கப்பட்ட கொள்கலன்

Non – unifor acceleration – சீரற்ற முடுக்கம்

Negative acceleration – எதிர் முடுக்கம்

Neptune – சூரிய குடும்பத்தில் உள்ள ஒரு கோளின் பெயர்

Orbit – ஆற்றல் மட்டம்

Particles – சிறிய துகள்கள்

Pollination – மகரந்தச் சேர்க்கை

Plaque – பல் சொத்தை / பல்தட்டை

Pustules – கொப்பளங்கள்

Positive acceleration – நேர் முடுக்கம்

Perihelion – சூரியனுக்கு அருகில் இருக்கும் பூமியின் நிலை (*position*)

Physical quantity – ஒரு பொருளின் இயற்பியல் பண்புகளின் அளவுகள்

Sexual reproduction – பாலினப் பெருக்கம்

Subatomic particles – அணுவகத் துகள்கள்

Self Pollination – தன் மகரந்தச் சேர்க்கை

Speed – வேகம்

System of international unit (SI) – பன்னாட்டு அலகு முறை

Tuberculosis – காச நோய்

Uniform acceleration – சீரான முடுக்கம்

Valency – இணைதிறன்

Vegetative propagation – உடலவழி இனப்பெருக்கம்

Velocity – திசைவேகம்

Vacuum – வெற்றிடம் (காற்று இல்லாத இடம்)

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